Cisco 12008 Gigabit Switch Router Installation and Configuration Guide

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You can determine whether your equipment is causing interference by turning it off. If the interference stops, it was probably caused by the Cisco equipment or one of its peripheral devices. If the equipment causes interference to radio or television reception, try to correct the interference by using one or more of the following measures:

• Turn the television or radio antenna until the interference stops.

• Move the equipment to one side or the other of the television or radio.

• Move the equipment farther away from the television or radio.

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CONTENTS

About This Guide

This section describes the objectives, intended audience, and organization of this document. The conventions used to convey instructions and information are also included.

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Document Objectives

This installation and configuration guide explains the hardware installation and basic configuration procedures for a Cisco 12008 router. It contains procedures for installing the hardware, creating a basic configuration file, and starting the router. After completing the installation and basic configuration procedures, you use appropriate companion publications to more completely configure your system.

Audience

In using this document, you are expected to be familiar with Cisco routers or equivalent hardware and cabling, electronic circuitry, and wiring practices. Also, experience as an electronic or electromechanical technician is beneficial.

Document Organization

This document is organized as follows:

- Chapter 1, “Product Overview,” introduces the Cisco 12008 router and describes the system’s components.
- Chapter 2, “Preparing for Installation,” outlines the safety considerations that you should observe and the tools required during installation of your Cisco 12008 router. Also, this chapter provides an overview of the installation process and presents the procedures you should perform *before* actually installing the router.
- Chapter 3, “Installing a Cisco 12008,” presents instructions for installing the hardware and connecting the external network interface cables.
- Chapter 4, “Observing System Startup and Performing a Basic Configuration,” presents simple procedures for completing a basic system configuration and checking and saving the configuration to system memory.
- Chapter 5, “Troubleshooting the Installation,” presents guidelines for troubleshooting the Cisco 12008 hardware installation.
- Chapter 6, “Running Diagnostics on the Cisco 12008,” tells you how to load and run the Cisco 12008 field diagnostics.
- Chapter 7, “Maintaining the Cisco 12008,” presents simple maintenance procedures that you might need to perform after installing the Cisco 12008. Also included in this chapter are removal and replacement procedures for the field-replaceable units (FRUs) available for the Cisco 12008.
- Appendix A, “Unpacking and Repacking the Cisco 12008,” presents instructions for repackaging the Cisco 12008 router should it need to be transported to another site.

Document Conventions

The conventions used in this document are described in the following sections.

Conventions Used in Command Descriptions

The following conventions are used for command descriptions:

- Examples containing system prompts denote interactive sessions. Such examples indicate that you should enter commands at the system prompt.

  The system prompt indicates the current level of the EXEC command interpreter. For example, the prompt `router>` indicates that you are at the *user* EXEC level; the prompt `router#` indicates that you are at the *privileged* EXEC level.

  Access to the privileged EXEC level requires a password. Refer to the section entitled "If You Need More Configuration Information" in Chapter 4 for additional information.

- Commands and keywords are in **boldface** font.
- Arguments for which you supply values are in *italic* font.
- Elements enclosed in square brackets ([ ]) are optional.
- Alternative, but required, keywords are grouped in braces ({ }) and separated by vertical bars (|).
- The symbol ^ represents the key labeled *Control*. For example, the key combination ***^Z*** means that you should hold down the *Control* key while pressing the *Z* key.

Conventions Used in Examples

The following conventions are used in examples:

- Terminal sessions and sample console screen displays are in `screen` font.
- Information that you enter is in **`boldface screen`** font.
- Nonprinting characters, such as passwords, are in angle brackets (< >).
- Default responses to system prompts are enclosed in square brackets ([ ]).
- An exclamation point (!) at the beginning of a line indicates a comment line.

Conventions Used for Special Notices

The following conventions are used to alert you to hazardous conditions that may exist in the workplace or to instruct you to proceed with care to avoid equipment damage or personal injury:

Caution Means *reader be careful*. You should avoid any action that might result in equipment damage or loss of data.

Note Means *reader take note*. Notes contain helpful suggestions or references to information not contained in this document.

Timesaver Means *the described action saves time*. You can save time by performing the action described in the paragraph.

Warning This warning symbol means *danger*. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the *Regulatory Compliance and Safety Information* document that accompanied this device.

Waarschuwing Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen. Voor vertalingen van de waarschuwingen die in deze publicatie verschijnen, kunt u het document *Regulatory Compliance and Safety Information* (Informatie over naleving van veiligheids- en andere voorschriften) raadplegen dat bij dit toestel is ingesloten.

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Warnung Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise finden Sie im Dokument *Regulatory Compliance and Safety Information* (Informationen zu behördlichen Vorschriften und Sicherheit), das zusammen mit diesem Gerät geliefert wurde.

Avvertenza Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti. La traduzione delle avvertenze riportate in questa pubblicazione si trova nel documento *Regulatory Compliance and Safety Information* (Conformità alle norme e informazioni sulla sicurezza) che accompagna questo dispositivo.

Advarsel Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du vare oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker. Hvis du vil se oversettelser av de advarslene som finnes i denne publikasjonen, kan du se i dokumentet *Regulatory Compliance and Safety Information* (Overholdelse av forskrifter og sikkerhetsinformasjon) som ble levert med denne enheten.

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- Telnet: cco.cisco.com
- Modem using standard connection rates and the following terminal settings: VT100 emulation; 8 data bits; no parity; and 1 stop bit.
  - From North America, call 408 526-8070
  - From Europe, call 33 1 64 46 40 82

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Kanji (Japanese)	japan-tac@cisco.com
Hangul (Korean)	korea-tac@cisco.com

Language	E-mail Address
Spanish	tac@cisco.com
Thai	thai-tac@cisco.com

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CHAPTER 1

Product Overview

This chapter presents an overview of the Cisco 12008 Gigabit Switch Router.

The following sections are included in this chapter:

- Cisco’s Next Generation of Routers
- Features of the Cisco 12008 Router
- Overview of the Cisco 12008
- Router Enclosure
- Cable-Management System
- Card Cage Fan Tray
- Power Supply Fan Tray
- AC-Input and DC-Input Power Supplies
- Upper Card Cage and Associated Components
- Air Filter Assembly
- Lower Card Cage and Associated Components
- Power Distribution System in the Cisco 12008
- Cisco 12008 Environmental Monitoring Facility
- System Specifications
- Agency Approvals

Cisco's Next Generation of Routers

Cisco Systems' new family of Internet switching and routing products, referred to collectively as the Cisco 12000 Series Gigabit Switch Routers, consists of the following models:

- Cisco 12016 Gigabit Switch Router—A 16-slot, carrier-class platform that supports Internet protocol (IP) switching capacity of up to 160 Gbps.
- Cisco 12012 Gigabit Switch Router—A 12-slot version that supports IP datagram switching capacities ranging from 15 to 60 Gbps.
- Cisco 12008 Gigabit Switch Router—An 8-slot version that supports IP datagram switching capacities ranging from 10 to 40 Gbps. The Cisco 12008 is the subject of this document.

The architecture of the Cisco 12000 Series Gigabit Switch Routers provides the following networking capabilities and features:

- Scalable bandwidth—Supports high-speed transmission of IP datagrams through use of Cisco 12000 series line cards. The network interfaces reside on the line cards, providing connectivity between the router's switch fabric and external networks.
- Scalable performance—Supports multi-gigabit bandwidth switching capacities ranging from 5 to 60 Gbps, providing high-performance support for IP-based networks and wide-area networks (WANs).
- Scalable services—Supports sophisticated congestion management, multicast services, and quality-of-service (QOS) features.
- Carrier-class design—Supports extensive SONET/Synchrononous Digital Hierarchy (SDH) integration; supports a hot-swapping capability for field-replaceable units (FRUs).

The networking capabilities and features of the Cisco 12000 series of routers make them ideally suited to meet the needs of the following classes of users:

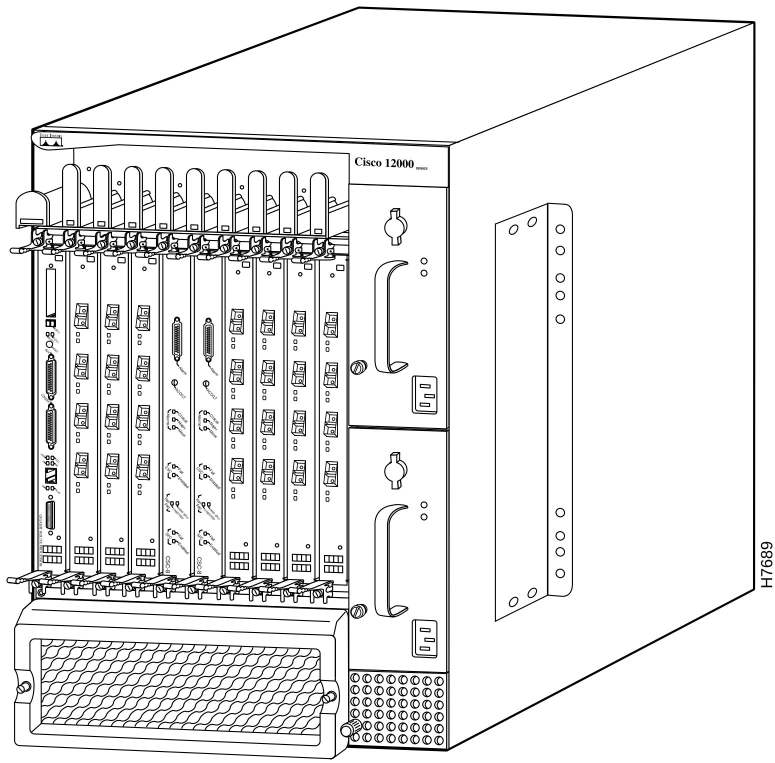
- Internet service providers (ISPs)
- Carriers providing Internet services and utilities
- Competitive access providers (CAPs)
- Enterprise wide-area network (WAN) backbones
- Metropolitan-area network (MAN) backbones

Features of the Cisco 12008 Router

The Cisco 12008 router incorporates a high-speed switching fabric that provides high data-handling capacities for IP-based local- and wide-area networks. Figure 1-1 is a front view of the Cisco 12008 router.

All of the router’s major components and FRUs are accessible from the front of the router enclosure, making the router easy to install, configure, and maintain.

Figure 1-1 Cisco 12008 Gigabit Switch Router



The Cisco 12008 supports the following features:

- Online insertion and removal (OIR) capability—This feature allows you to insert or remove the following router components:
  - — Power supplies—One AC-input power supply or one DC-input power supply is a required router component. You can remove or replace a power supply, without disrupting system operations, only if a second (redundant) unit of the same type is installed in the system.

The power supplies of both types are hot-swappable, load-sharing units. In a system equipped with two AC-input power supplies or two DC-input power supplies, if one of the units fails or if the power source for one of the units fails, the surviving power supply continues to operate to sustain normal router operations.

Note The Cisco 12008 does not support a mixture of AC-input and DC-input power supplies.

- Cisco 12000 series line cards—Any line card supported by the Cisco 12008 router can be inserted into or removed from the router with no disruption to system operations.

  However, the functions performed by the removed card are lost to the system temporarily until the card is either reinstalled or replaced by a like (and identically configured) line card.

- Route Processor (RP)—As a required router component, an RP can be removed and replaced, but you must power down the router before doing so.

  An RP must be installed and operational at all times for normal system operations to be sustained.

- Clock and scheduler card (CSC)—Also a required component, a CSC can be removed and replaced, without disrupting normal system operations, only if a second (redundant) CSC is installed in the system.

  One CSC must be present and operational at all times to maintain normal system operations.

- Switch fabric card (SFC)—An optional set of three SFCs can be installed in the router at any time to provide additional switch fabric to the router. These cards increase the data handling capacity of the router.

  Any one or all of the SFCs can be removed and replaced at any time without system operations being disrupted or the router being powered down.

  For the length of time that any SFC is not functional, its switch fabric is lost to the router as a potential data path for the router's data handling and switching functions.

Separately orderable documents called *configuration notes* or *replacement instructions* are available for each of the FRUs described previously. These documents provide installation, removal, replacement, and configuration instructions for the FRUs.

- Environmental monitoring system—The maintenance bus (MBus) facility of the Cisco 12008 functions as an environmental monitoring system for the router, enabling the router to monitor itself and alert site personnel to adverse electrical events or environmental conditions.

  MBus software running in the RP, in combination with LEDs on the CSC faceplate, keep site personnel informed regarding the operational state of the router.

  By signaling alarm conditions, such as component overheating or out-of-tolerance voltages, the router enables you to resolve adverse environmental conditions before operational limits are exceeded, thus preventing the router from shutting down.

  The MBus facility of the router is described in greater detail in the section entitled “Cisco 12008 Environmental Monitoring Facility” on page 74.

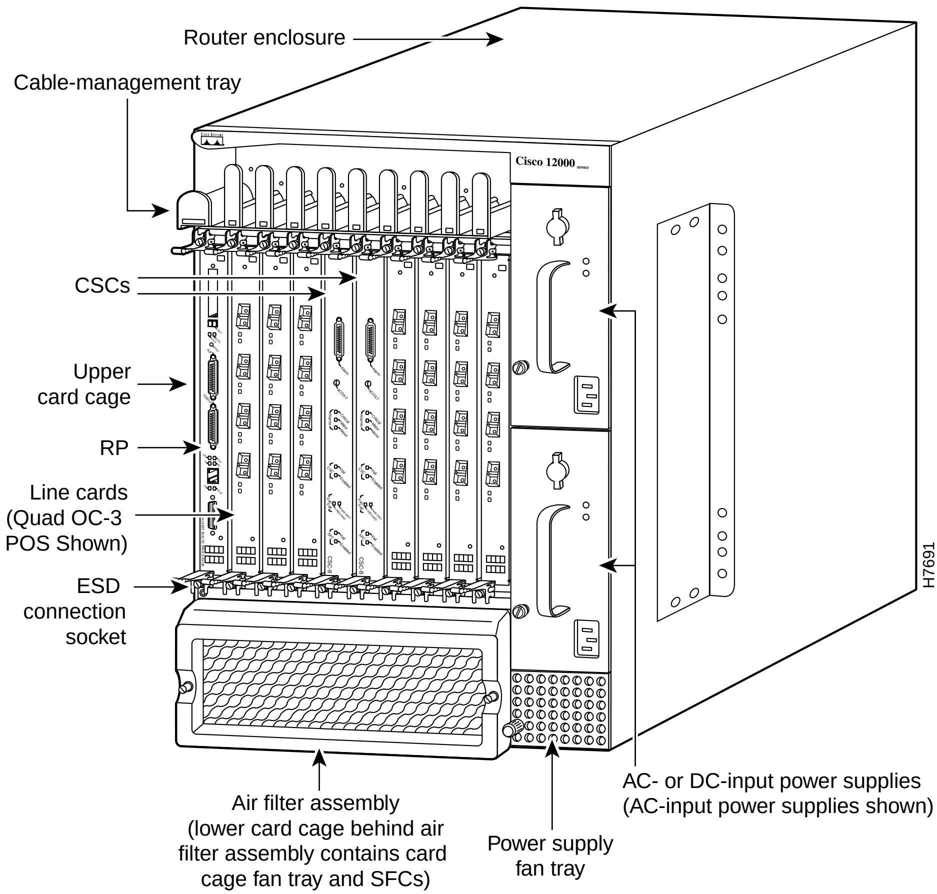
- Downloadable software—This feature allows you to remotely load new operational software into Flash memory on the RP without physically accessing the router. Thus, you can quickly, easily, and reliably perform software upgrades at any time.

Overview of the Cisco 12008

The Cisco 12008 is a modular system consisting of the elements shown in Figure 1-2.

The following sections describe the major elements of the Cisco 12008 in greater detail.

Figure 1-2 Major Components of the Cisco 12008



Router Enclosure

The outer shell of the Cisco 12008 is a rigid, sheet metal structure with the following dimensions:

- Width—17.4 inches (44.6 cm)
- Depth—21.2 inches (54.4 cm)
- Height— 24.8 inches (63.6 cm)

This enclosure, which houses all of the router's internal components, can be mounted in a telco rack or a four-post equipment rack, or the enclosure can be used as a freestanding unit.

The design of the enclosure permits front accessibility of all router components. All router components plug into a backplane that provides operating power for the components and interconnects them with each other.

The backplane, which is covered by a sheet metal panel that helps to completely enclose the rear of the router, incorporates a nonvolatile random access memory (NVRAM) module that stores the backplane serial number for identification and revision control purposes. The contents of the NVRAM module are accessible from any line card slot.

Cable-Management System

The cable-management system provides an orderly and convenient way for you to manage the network interface cables running to and from the receive and transmit ports of installed line cards.

Consisting of a cable-management tray and a vertical cable-management bracket (one bracket for each installed line card), the cable-management system (see Figure 1-3) secures the network interface cables neatly in place. The cable management system helps to optimize optical cable performance by eliminating any kinks or sharp bends in the cables. Extreme curvatures in optical cables tend to degrade their performance.

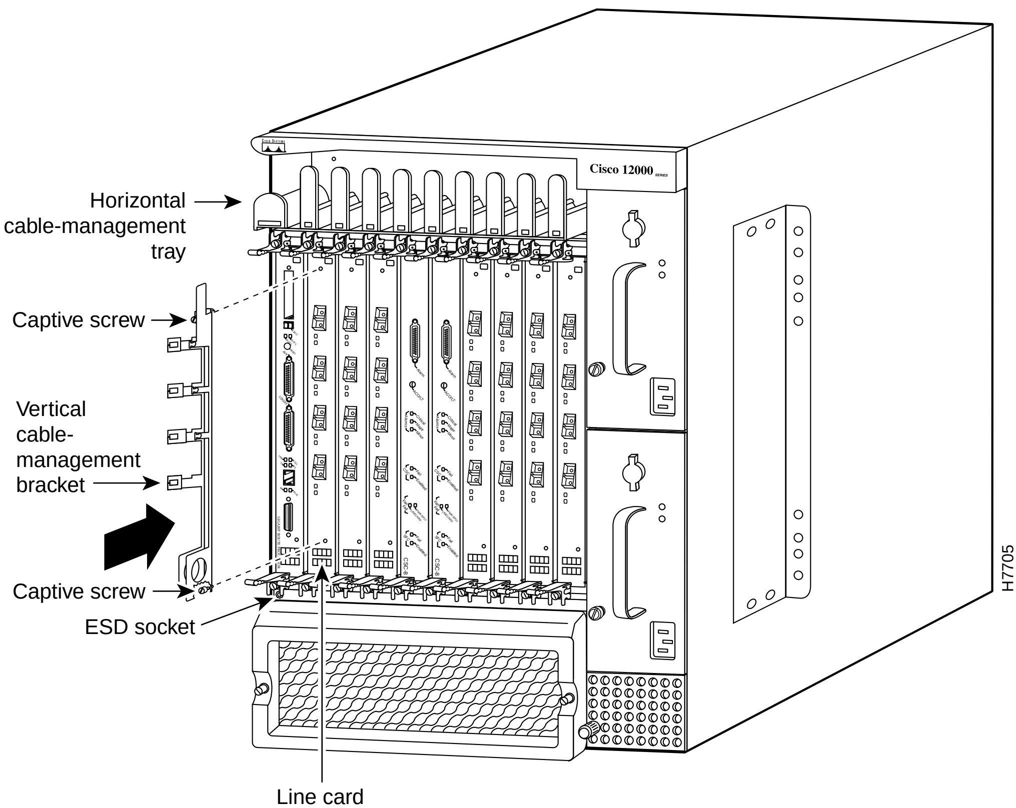
The elements of the cable-management system are shown in Figure 1-3 and described briefly in the following sections:

- Cable-management tray—This tray is attached to the router enclosure above the upper card cage.

The cable management tray enables you to route the line card interface cables to or from the system through the left side of the tray, keeping the cables organized, out of the way, and free of kinks or sharp bends.

You direct the cables down to the individual ports on each line card, gauging cable length appropriately to minimize slack in the cable before connecting it to a given port.

Figure 1-3 Cable-Management System



- Vertical cable-management bracket (one per line card)—This bracket is attached to a line card by means of captive installation screws at the top and bottom of the bracket.

  Once an interface cable is connected to its intended line card port, you loop the cable through the cable keeper clip nearest the port of connection and seat the cable in the bottom of the bracket raceway.

  Thus, the vertical cable-management bracket enables you to neatly “dress” all the interface cables in place as you connect them to the individual line card ports.

  Later, when you remove or replace a line card, you need only disconnect the cables from the individual line card ports (leaving the cables intact within the vertical cable-management bracket) and detach the bracket from the line card to be replaced.

  When you install the new line card, you merely reattach the vertical cable-management bracket to the new line card and reconnect the interface cables to the appropriate line card port(s).

Card Cage Fan Tray

The card cage fan tray is located in the lower card cage behind the air filter assembly (see Figure 1-2). This fan tray maintains the operating temperature of the router’s electronic circuitry within an acceptable range.

Designed for simplicity, the card cage fan tray incorporates six fans mounted on a sheet metal carrier. The assembly also contains associated wiring and a connector in the back of the unit that enables it to draw operating power through the backplane from a DC-DC converter on the CSC.

Guide rails in the sides of the lower card cage facilitate insertion and removal of the fan tray assembly, which is secured in place by means of a captive installation screw on each side of the metal carrier.

Under normal operating conditions, the variable-speed fans in the card cage fan tray operate at a reduced rate to

- Conserve power
- Reduce noise
- Minimize fan wear

If an overtemperature condition or a fan failure is detected within the router, the master MBus module on the RP directs the MBus module on the clock and scheduler card (CSC) to increase the operating voltage being delivered to the fan tray, causing the card cage fans to run at “maximum” speed. This increases the volume of cooling air flowing through the router.

If the increased fan speed does not alleviate the overtemperature condition in the affected board, the MBus module on the board shuts down the board’s power supply, taking the board offline to protect it from thermal damage.

The MBus facility of the Cisco 12008 router is described in greater detail in the section entitled “Cisco 12008 Environmental Monitoring Facility” on page 74.

Power Supply Fan Tray

The power supply fan tray is in the bottom of the power supply bays (see Figure 1-2). This fan tray maintains the temperature of the installed power supply(ies) within an acceptable range.

Also designed for simplicity, the power supply fan tray incorporates four fans mounted on a sheet metal carrier. The fan tray assembly contains associated wiring and a connector in the back of the unit that enables it to draw operating power through the backplane from a DC-DC converter on the CSC.

A captive installation screw mounted on the fan tray faceplate and guide rails in the sides of the power supply bay facilitate insertion and removal of the unit. Once the unit is inserted, you secure it in place by tightening the captive installation screw clockwise.

Similar to the card cage fan tray, the power supply fan tray is closely tied to the router’s overall environmental monitoring system. If an overheating condition or a fan failure is detected within the router, the voltage being delivered to the power supply fans by the CSC is also increased, thereby causing the power supply fans to run at “maximum speed” to increase the volume of cooling passing through the power supply bays.

AC-Input and DC-Input Power Supplies

The Cisco 12008 router can be configured to operate with AC source power or DC source power. You can install one or two AC-input power supplies or one or two DC-input power supplies in the power supply bays located in the right side of the router enclosure (see Figure 1-2).

A single power supply of either type is the standard router configuration. In such a configuration, it is recommended that you install the power supply in the lower bay.

You can install a second (optional and redundant) power supply of the same type for backup purposes.

Caution A vacant power supply bay must be covered with a blank filler panel to ensure proper flow of cooling air through the power supply bays and to satisfy EMI compliance requirements.

Note You cannot use an AC-input power supply in conjunction with a DC-input power supply. Installed power supplies must always be of the same type. Furthermore, you should not install two power supplies of either type unless you intend to actively use both units. In other words, you should not power the router with a single power supply while using the other bay to temporarily or indefinitely “store” an inert unit. Doing so will disrupt the normal flow of cooling air through the router enclosure.

Figure 1-4 shows an AC-input power supply; Figure 1-5 shows a DC-input power supply.

Figure 1-4 AC-Input Power Supply

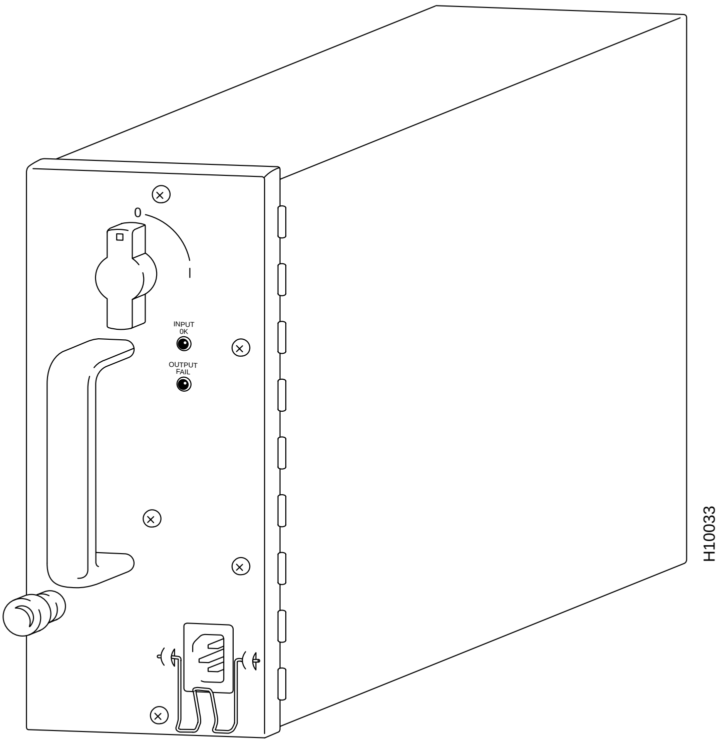
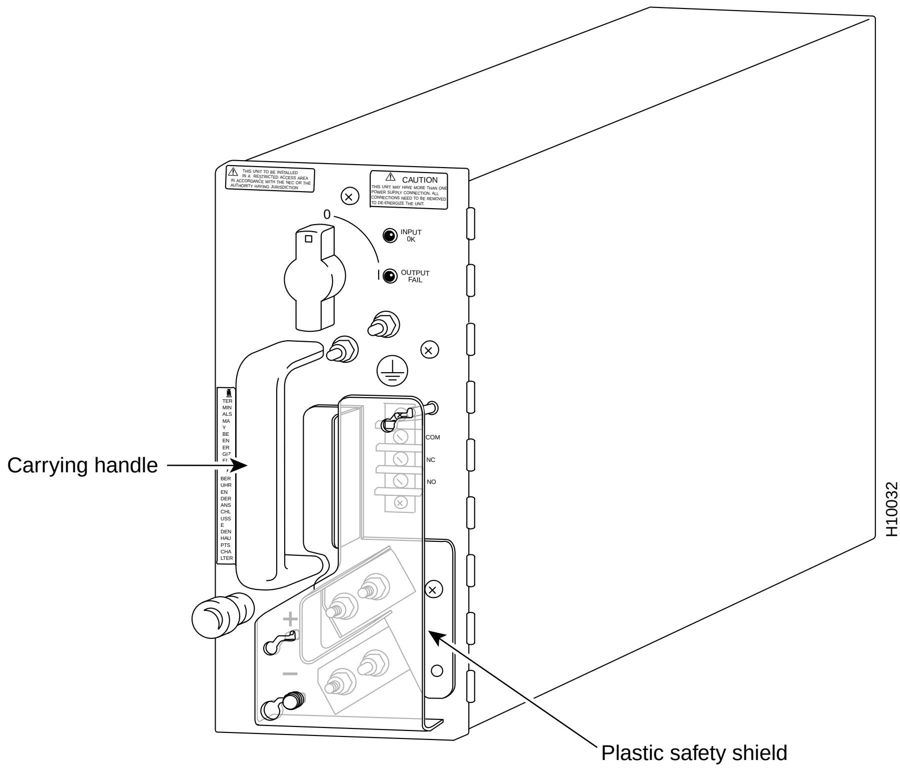


Figure 1-5 DC-Input Power Supply



Operating Modes of the Power Supplies

The AC-input and DC-input power supplies operate in either of two modes:

- Standalone mode—In this configuration, only one power supply is installed in one of the two available power supply bays. To remove or replace a single power supply, you must first power down the system.

- Redundant (1+1) mode—In this configuration, two power supplies are installed in the power supply bays, sharing the load current to provide required DC operating voltages to the backplane. If one of the units fails, the surviving power supply takes over to maintain normal system operations.

  The online insertion and removal (OIR) capability of the router enables you to add or remove a redundant power supply without introducing noise in the DC operating voltages being supplied to the backplane.

Features of the Power Supplies

The AC-input and DC-input power supplies incorporate the following features:

- Onboard maintenance bus (MBus) module—The MBus module on the power supply is a microprocessor-based subassembly that links the power supply to the router's environmental monitoring system.

  The environmental monitoring system includes identical MBus modules on all of the router circuit boards, including the RP. This system enables you to perform router functions and to respond to alarm conditions (such as overtemperature or overvoltage conditions).

  An alarm condition in the router causes the MBus module on the CSC to illuminate an appropriate LED on the card faceplate, providing a visible notification of the alarm condition.
- Blind mating connector at the back of the unit—Supplies DC operating voltages to the backplane for distribution to the router's electronic and electrical components.
- OIR capability—Enables a second AC-input power supply to be installed in or removed from the router without disrupting normal system operations.
- Temperature sensor—Measures the ambient air temperature of the power supply.

Characteristics of the Power Supplies

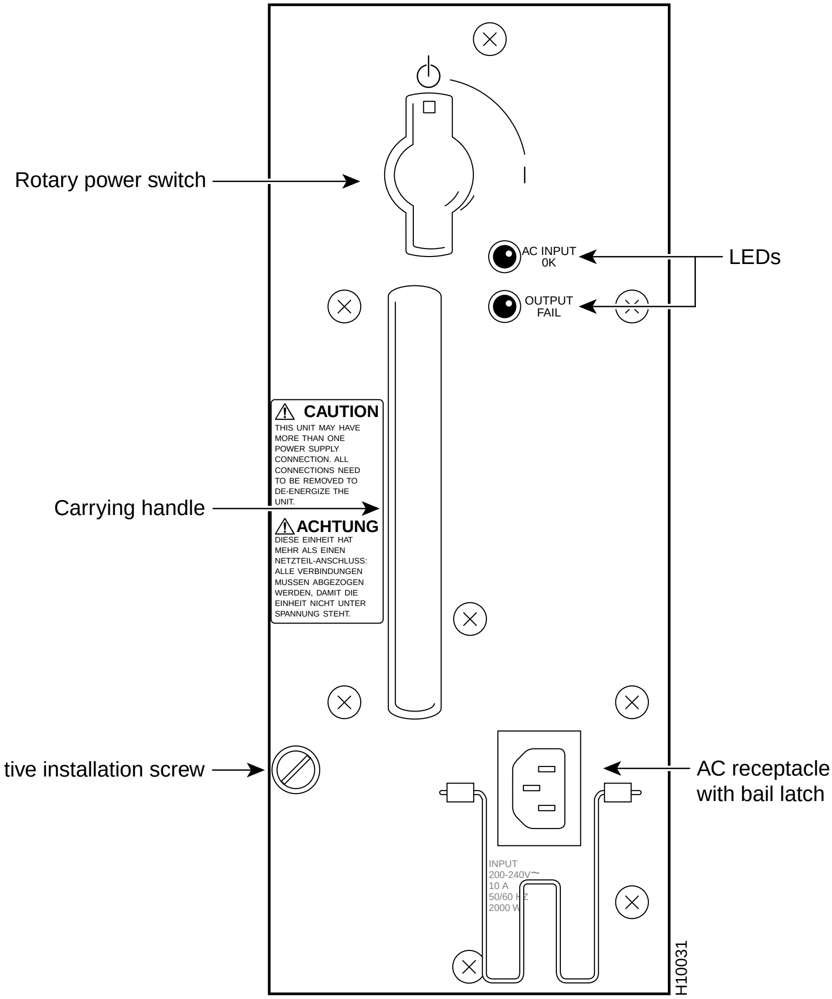
The AC-input and the DC-input power supplies have the following characteristics:

- Width of power supply body—3.5 inches (8.97 cm)
- Width of power supply faceplate—4.0 inches (10.26 cm)
- Height—10 inches (25.64 cm)
- Depth—17.6 inches (45.13 cm)
- Weight (AC-input power supply)—17 lb (7.73 kg)
- Weight (DC-input power supply)—14 lb (6.36 kg)
- Power factor corrector (PFC)—Applicable only to the AC-input power supply, the PFC enables the power supply to accept source AC voltages with the following characteristics: voltages ranging from 180 to 264 VAC, single phase, 47 to 63 Hz.

AC-Input Power Supply Faceplate

This section describes the functional elements built into the faceplate of the AC-input power supply (see Figure 1-6).

Figure 1-6 AC-Input Power Supply Faceplate



Rotary Power Switch

The rotary power switch on the power supply faceplate (see Figure 1-6) applies a source AC voltage to the power supply. This switch also actuates an onboard circuit breaker and a latching mechanism that prevents the power supply from being inserted into or removed from the power supply bay when the switch is in the ON (1) position.

When you rotate the rotary power switch 90 degrees to the ON position, the following DC operating voltages are supplied to the backplane:

- +5.2 VDC
- –48 VDC

Source AC Input Connector

The source AC receptacle on the power supply faceplate (see Figure 1-6) enables an external AC power source to be connected to the power supply. This connector is equipped with a latch that prevents accidental or unintended removal of the AC power cord.

The power specifications for the AC-input power supplies, as well as the source AC power cables available for use with the Cisco 12008 router, are described in Chapter 2 in the section entitled “AC-Powered Systems.”

AC-Input Power Supply LEDs

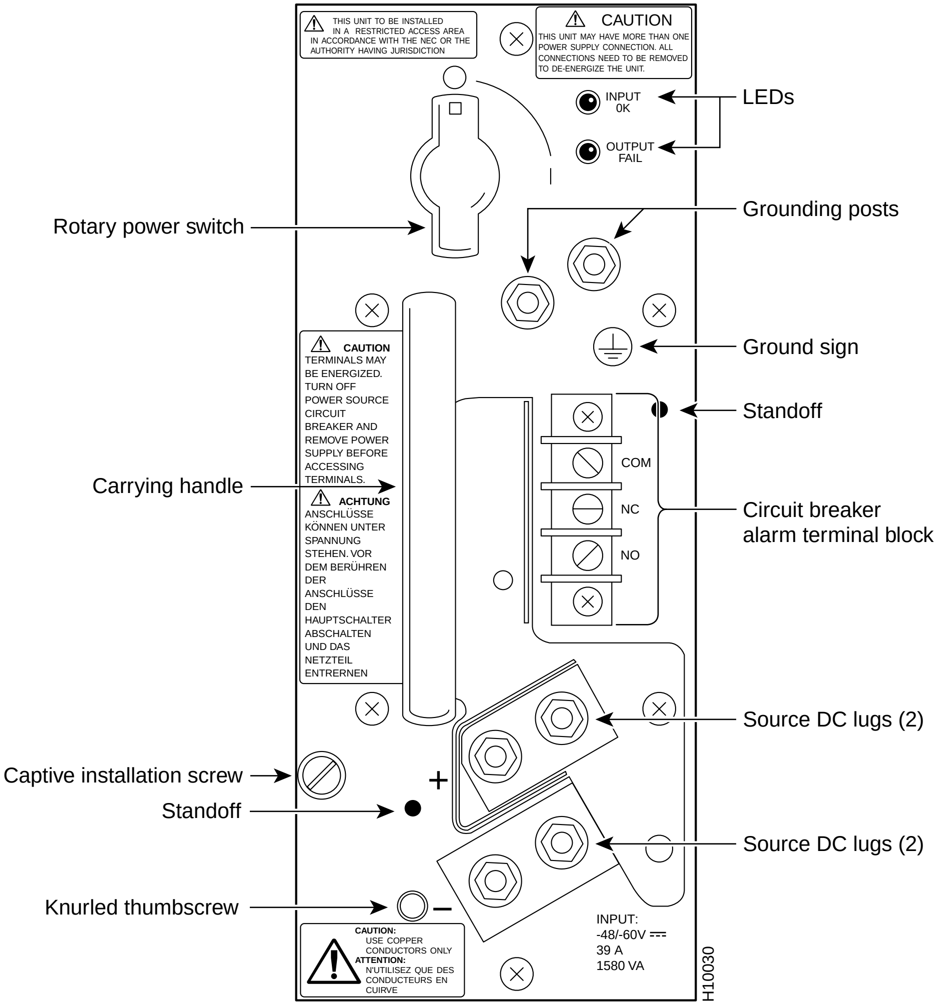
The AC-input power supply faceplate incorporates two LEDs (see Figure 1-6) that provide the following status indications:

- AC INPUT OK—When the rotary power switch is turned ON, this green LED goes on, indicating that source AC power has been applied and that it is within the specified operating range. If this LED does not go on when the rotary power switch is turned ON, it indicates that source AC power is not within the specified operating range or that the LED is faulty.
- OUTPUT FAIL—When the rotary power switch is turned on, this LED goes on momentarily; it should then go off and remain so. If it does not go off, it indicates that the +5.2 VDC or –48 VDC being supplied to the backplane is not within tolerance.

DC-Input Power Supply Faceplate

This section describes the functional elements built into the faceplate of the DC-input power supply (see Figure 1-7).

Figure 1-7 DC-Input Power Supply Faceplate



Rotary Power Switch

The rotary power switch on the DC-input power supply performs the same functions as those described in the section entitled “Rotary Power Switch” on page 18 for the AC-input power supply.

Circuit Breaker Alarm Terminal Block

The onboard power supply circuit breaker actuated by the rotary power switch on the DC-input power supply incorporates an auxiliary switch that is mechanically linked to (but electrically isolated from) the power supply circuit breaker.

When the power supply circuit breaker is tripped by an overcurrent condition in the power supply, this auxiliary switch moves in unison, sending a signal to the circuit breaker alarm terminal block on the power supply faceplate (see Figure 1-7).

To remotely sense when the power supply circuit breaker has been tripped during an overcurrent condition, you can attach an external alarm-monitoring facility to the alarm terminal block. When the power supply circuit breaker is tripped, power is no longer delivered to the backplane and the router ceases to operate. Hence, if you have attached an external alarm monitoring facility to the alarm terminal block, site personnel can be instantly alerted to this serious fault condition.

Typically, an external alarm-monitoring system incorporates a light panel (visible alarm) or a klaxon (audible alarm) as the means for alerting site personnel to an alarm condition.

To reset the alarm contacts on the alarm terminal block, you must turn the rotary power switch on the power supply OFF and then ON again, much as you would reset any circuit breaker.

Note Any time you manually actuate the rotary power switch, such as when powering down the router, the contacts on the alarm terminal block remain unaffected. Hence, activation of the contacts on the alarm terminal block occurs only during a power supply overcurrent condition. In other words, these contacts are used to provide an immediate, overt indication of a power supply fault condition; they are not used to merely indicate that a circuit breaker has been turned off manually.

The three contacts on the alarm terminal block are labeled as follows:

- COM (Common)—This contact is common to both the Normally Open (NO) and the Normally Closed (NC) contacts.
- NO (Normally Open)—These contacts on the alarm terminal block are open as long as no overcurrent condition is detected in the power supply. When the power supply circuit breaker is tripped during an overcurrent condition, these contacts are closed.
- NC (Normally Closed)—These contacts on the alarm terminal block are closed as long as no overcurrent condition is detected in the power supply. When the power supply circuit breaker is tripped during an overcurrent condition, these contacts are open.

Table 1-1 summarizes the status of the contacts on the alarm terminal block during an overcurrent condition in the power supply.

Table 1-1 Circuit Breaker Status Indicated by the Alarm Terminal Block

Circuit Breaker Position	NC Contact	NO Contact
OFF (tripped)	Open	Closed
ON	Closed	Open

If you decide to use an external alarm-monitoring facility in conjunction with the alarm terminal block, note that the contacts on the alarm terminal block have a rating of 60 VDC at 1A maximum.

Source DC Input Connectors

The faceplate of the DC-input power supply incorporates three sets of terminals for connecting source DC power to the power supply (see Figure 1-7). From top to bottom, these terminals are identified as follows:

- Ground
- **+** (positive)
- **–** (negative)

The power specifications for the DC-input power supplies, as well as the specifications of the source DC power cables for use with the Cisco 12008 router, are presented in the section entitled “DC-Powered Systems” on page 16 in Chapter 2.

DC-Input Power Supply LEDs

The DC-input power supply faceplate incorporates two LEDs (see Figure 1-7) that provide the following status indications:

- INPUT OK—When the rotary power switch is turned ON, this green LED goes on immediately, indicating that source DC power is applied and that it is within the specified operating range (–40.5 VDC to –75 VDC). If this LED does not go on when the rotary power switch is turned ON, the source DC power being applied to the power supply is not within the normal operating range or the LED is faulty.
- OUTPUT FAIL—When the rotary power switch is turned on, this LED goes on momentarily; it should then go off and remain so. If it does not go off, it indicates that the +5.2 VDC or –48 VDC being supplied to the backplane is not within tolerance.

Upper Card Cage and Associated Components

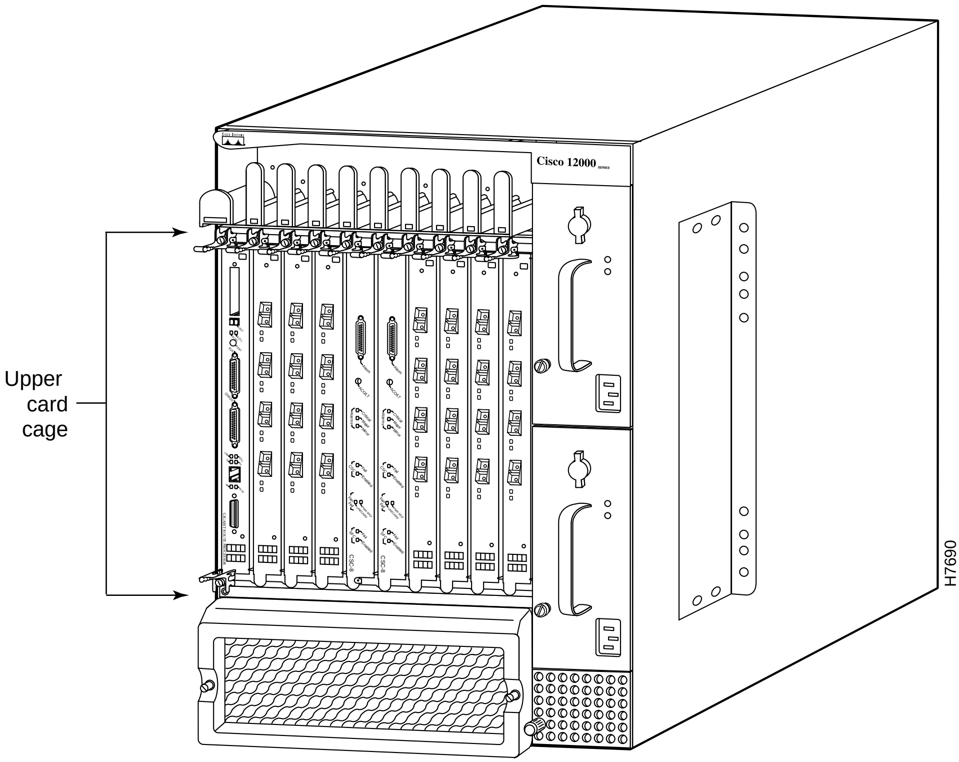
The upper card cage (see Figure 1-8) contains ten slots that accommodate the following types of cards in the quantities indicated:

- One Route Processor (RP)—A RP is a standard and required router component; the RP must be present and operational at all times. It is recommended that you install the RP in the left-most slot (slot 0) in the upper card cage.
- Either one or two clock and scheduler cards (CSCs)—One CSC is a standard and required router component; one CSC must be present and operational in the router at all times. For redundancy, you can install a second CSC for use as a backup.

  Two dedicated slots in the middle of the upper card cage (CSC0 and CSC1) are reserved for the CSCs. Because the backplane connector of a CSC differs significantly from all other card types, you cannot install a CSC in any other slot.
- Cisco 12000 series line cards—From one to seven line cards of different types can be installed in the line card slots in the upper cage (slots 0 through 3 and slots 4 through 7).

Although you can install a line card in slot 0, the recommended convention is for the RP to occupy this slot.

Figure 1-8 Upper Card Cage of the Cisco 12008 Router



A minimally configured Cisco 12008 contains the following cards in the upper card cage:

- One RP
- One CSC
- One Cisco 12000 series line card of any type

A Cisco 12008 that is configured for full redundancy contains the following cards in the upper card cage:

- Two RPs
- Two CSCs
- As many as six Cisco 12000 series line cards of any type and any combination

The following sections briefly describe the cards that you can use to populate the upper card cage.

Gigabit Route Processor

Each Cisco 12008 GSR has one main system (or route) processor. The route processor (RP) processes the network routing protocols and distributes updates to the Cisco Express Forwarding (CEF) tables on the line cards. The RP also performs general maintenance functions, such as diagnostics, console support, and line card monitoring.

Two types of RPs are available for the Cisco 12008 GSR:

- Gigabit Route Processor (GRP)
- Performance Route Processor (PRP)

When not explicitly specified, this document uses the term route processor (RP) to indicate either the GRP or the PRP.

Note If you install a second, redundant RP, it must be of the same type as the primary RP.

This section describes the GRP and includes the following information:

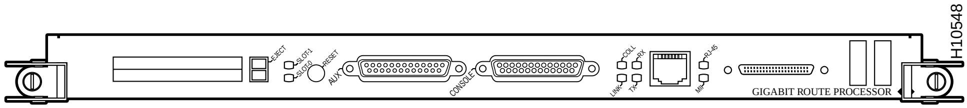
- Memory components
- System status LEDs
- Soft reset switch
- Personal Computer Memory Card Industry Association (PCMCIA) slots, which are used to transmit data to or from Flash memory cards

- Asynchronous serial ports
- Ethernet port

If you have a PRP, see the Performance Route Processor section.

The faceplate of the GRP is shown in Figure 1-9.

Figure 1-9 GRP Faceplate (Horizontal Orientation Shown)



It is recommended that you install the GRP in the left-most slot (slot 0) in the upper card cage. However, you need not abide by this recommendation. You can install the GRP in any upper card cage slot, except for the two slots in the middle in the upper card cage (CSC0 and CSC1), which are reserved for the CSCs.

The GRP performs the following functions:

- Downloading the Cisco IOS software to all of the installed line cards at power up
- Providing a console (terminal) port for router configuration
- Providing an auxiliary port for other external equipment (such as modems)
- Providing an IEEE 802.3, 10/100-megabits-per-second (Mbps) Ethernet port for Telnet functionality
- Running routing protocols
- Building and distributing routing tables to line cards
- Providing general system maintenance functions

The GRP communicates with the line cards either through the switch fabric or through a maintenance bus (MBus). The switch fabric connection is the main data path for routing table distribution as well as for packets that are sent between the line cards and the GRP. The MBus connection allows the GRP to download a system bootstrap image, collect or load diagnostic information, and perform general, internal system maintenance operations. The GRP plugs into any slot in the upper card cage in the Cisco 12008 except the rightmost slot, which is reserved for the alarm card.

The GRP contains the following components:

- IDT R5000 Reduced Instruction Set Computing (RISC) processor used for the CPU. The CPU runs at an external bus clock speed of 100 MHz and an internal clock speed of 200 MHz.
- Up to 256 megabytes (MB) of parity-protected, extended data output (EDO) dynamic random-access memory (DRAM) on two, 60-nanosecond (ns), dual in-line memory modules (DIMMs); 64 MB of DRAM is the minimum shipping configuration.
- 512 kilobytes (KB) of static random-access memory (SRAM) for secondary CPU cache memory functions (SRAM is *not* user configurable or field upgradeable).
- 512 KB of NVRAM (NVRAM is *not* user configurable or field upgradeable).
- Most of the additional memory components used by the system, including onboard Flash memory (8-MB) and up to two PCMCIA-based Flash memory cards. The default GRP PCMCIA Flash memory is 20 megabytes (MB).
- Air-temperature sensors for environmental monitoring.

The Cisco IOS software images that run the Cisco 12008 reside in Flash memory, which is located on the GRP in the form of a single in-line memory module (SIMM), and on up to two Personal Computer Memory Card International Association (PCMCIA) cards (called *Flash memory cards*) that insert in the two PCMCIA slots (slot 0 and slot 1) on the front of the GRP. (See Figure 1-9.) Storing the Cisco IOS images in Flash memory enables you to download and boot from upgraded Cisco IOS images remotely or from software images resident in GRP Flash memory.

Note EIA/TIA-232 was previously known as recommended standard RS-232 before its acceptance as a standard by the Electronic Industries Association (EIA) and the Telecommunications Industry Association (TIA).

The Cisco 12008 supports downloadable system software for most Cisco IOS software upgrades, enabling you to remotely download, store, and boot from a new Cisco IOS software image.

GRP Memory Components

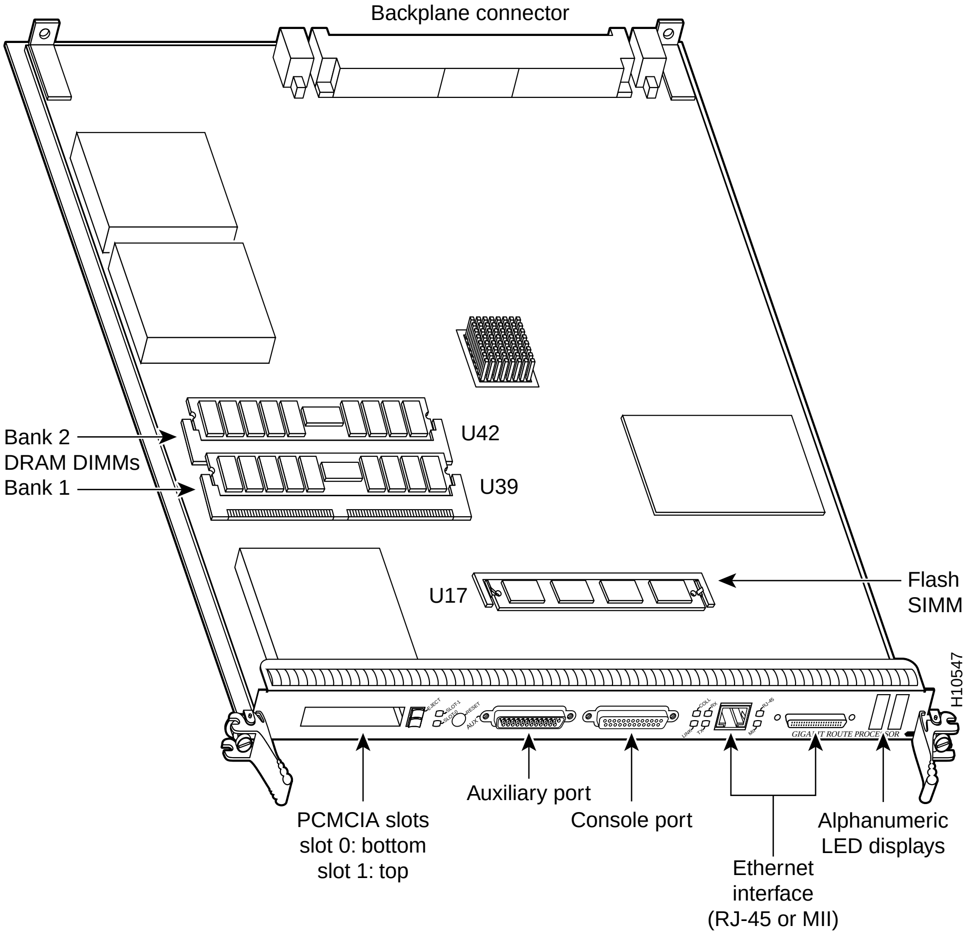
Table 1-2 lists the memory components on the GRP. Figure 1-10 shows the location of the two DRAM SIMMs and the Flash SIMM on the GRP.

Table 1-2 GRP Memory Components

Memory Type	Memory Size	Quantity	Description
DRAM	64[1] to 256 MB	1 or 2	64- or 128-MB DIMMs (based on DRAM required) for main Cisco IOS software functions
SRAM	512 KB (fixed)[2]		SRAM for secondary CPU cache memory functions
NVRAM	512 KB (fixed)[3]		MVRAM for the system configuration file
Flash memory SIMM[4]	8 MB	1	Contains Cisco IOS software images and other user-defined files on the GRP
Flash memory (card)	20 MB[5]	1 or 2	Contains Cisco IOS software images and other user-defined files on up to two PCMCIA-based Flash memory cards[6]
Flash boot ROM	512 KB	1	Flash EPROM for the ROM monitor program boot image

1. 64 MB of DRAM is the default DRAM configuration for the GRP.
2. SRAM is not user configurable or field upgradeable.
3. NVRAM is not user configurable or field upgradeable.
4. The SIMM socket is wired according to Cisco's own design and does not accept industry-standard 80-pin Flash SIMMs.
5. 20-MB Flash memory card is the default shipping configuration for the Cisco 12008.
6. A Type 1 or Type 2 PCMCIA card can be used in either PCMCIA slot.

Figure 1-10 Locations of GRP Memory



DRAM

The extended data output (EDO) dynamic random-access memory (DRAM) on the GRP stores routing tables, protocols, and network accounting applications, and runs the Cisco IOS software. The standard (default) GRP DRAM configuration is 64 megabytes (MB) of EDO DRAM, which you can increase up to 256 MB through DRAM upgrades. The Cisco IOS software runs from within GRP DRAM.

Two DRAM DIMM sockets are incorporated into the GRP, as shown in Figure 1-10. These sockets, labeled U39 (P4 DRAM bank 1) and U42 (P4 DRAM bank 2), enable you to configure DRAM in increments ranging from 64 MB to 256 MB. Table 1-3 lists the available upgrade configurations for DRAM on the GRP.

Table 1-3 DRAM Configurations

Total DRAM	Product Numbers	DRAM Sockets	Number of DIMMs
64 MB[1]	MEM-GRP/LC-64(=)	U39 (bank 1)	1 64-MB DIMM
128 MB	MEM-GRP/LC-64(=)	U39 (bank 1) and U42 (bank 2)	2 64-MB DIMMs
128 MB	MEM-GRP/LC-128(=)	U39 (bank 1)	1 128-MB DIMM
256 MB	MEM-GRP/LC-256(=)	U39 (bank 1) and U42 (bank 2)	2 128-MB DIMMs

1. 64 MB is the standard (default) DRAM configuration for the GRP.

Caution To prevent memory problems, DRAM DIMMs must be 3.3 V, 60-nanosecond (ns) devices. Do not attempt to install memory devices in the DIMM sockets that do not meet these requirements.

SRAM

SRAM provides secondary CPU cache memory. The standard GRP configuration is 512 KB. Its principle function is to act as a staging area for routing tables update information to and from the line cards. SRAM is not user configurable or field-upgradeable.

NVRAM

The system configuration, software configuration register settings, and environmental monitoring logs are contained in the 512-KB NVRAM, which is backed up with built-in lithium batteries that retain the contents for a minimum of five years. NVRAM is not user configurable or field-upgradeable.

Caution Before you replace the GRP in the system, back up the running configuration to a Trivial File Transfer Protocol (TFTP) file server or an installed Flash memory card so you can retrieve it later. If the configuration is not saved, the entire configuration will be lost—inside the NVRAM on the removed GRP—and you will have to reenter the entire configuration manually. This procedure is not necessary if you are temporarily removing a GRP; lithium batteries retain the configuration in memory until you replace the GRP in the system.

Flash Memory

Both the onboard and PCMCIA card-based Flash memory allow you to remotely load and store multiple Cisco IOS software and microcode images. You can download a new image over the network or from a local server and then add the new image to Flash memory or replace the existing files. You can then boot the routers either manually or automatically from any of the stored images. Flash memory also functions as a TFTP server to allow other servers to boot remotely from stored images or to copy them into their own Flash memory.

System Status LEDs

This section describes the two types of system status LEDs used on the GRP: the LED indicators and the alphanumeric LED displays.

- The GRP has the following eight LED indicators:
    - Two PCMCIA activity LEDs (one per PCMCIA slot): these LEDs light when the slot is accessed. The LEDs receive power from the switched slot voltage.
    - Four RJ-45 Ethernet port LEDs: these LEDs are used in conjunction with the RJ-45 Ethernet connector. When the MII Ethernet port is in use, the LEDs are disabled. The LEDs indicate link activity, collision detection, data transmission, and data reception.

- Two RJ-45 or MII Ethernet port select LEDs: these LEDs, when on, identify which one of the two Ethernet connections you selected. When the RJ-45 port is selected, its LED is on and the MII LED is off. When the MII port is selected, its LED is on and the RJ-45 LED is off.

- The alphanumeric displays are organized as two rows of four characters each. The displays' content is controlled by the MBus module software. The displays' content is controlled by the GRP's MBus module software. Both rows of the display are powered by the MBus module.

  These alphanumeric displays provide information about the following:

  - System status messages that are displayed during the boot process
  - System status messages that are displayed after the boot process is complete

  During the boot process, the alphanumeric LED displays are controlled directly by the MBus. After the boot process, they are controlled by the Cisco IOS software (via the MBus), and display messages designated by the Cisco IOS software.

  The following levels of system operation are displayed:

  - Status of the GRP
  - System error messages
  - User-defined status/error messages

Note A complete, descriptive list of all system and error messages is located in the *Cisco IOS System Error Messages* publications.

Soft Reset Switch

A soft reset switch is provided on the GRP faceplate to enable you to reset the software running on the R5000 RISC processor of the GRP. You access this switch through a small aperture in the GRP faceplate. To activate the switch, you can press a ball-point pen or similar pointed instrument into the opening.

Caution To prevent system problems or loss of data, use the soft reset switch only at the advice of Cisco service personnel.

PCMCIA Slots

The GRP has two PCMCIA slots available. Either slot can support a Flash memory card or an input/output (I/O) device as long as the device requires only +5 VDC. The GRP supports Type 1 and Type 2 devices; it does not support +3.3 VDC PCMCIA devices. Each PCMCIA slot has an ejector button for ejecting a PCMCIA card from the slot.

Asynchronous Serial Ports

Two asynchronous serial ports are provided on the GRP faceplate—a console port and an auxiliary port. These ports enable you to connect external devices that you can use to monitor and manage the system.

- Console port—The console port is an Electronics Industries Association/ Telecommunications Industry Association (EIA/TIA)-232 female receptacle that provides a data circuit-terminating equipment (DCE) interface for connecting a console terminal.
- Auxiliary port—The auxiliary port is an EIA/TIA-232 male plug that provides a data terminal equipment (DTE) interface. This auxiliary port supports flow control and is often used to connect a modem, a channel service unit (CSU), or other optional equipment for Telnet management.

Ethernet Port

The GRP has one Ethernet port that you can access using either of the following connection types:

- RJ-45 receptacle: an 8-pin, media dependent interface (MDI) that supports an IEEE 802.3 10BaseT (10 Mbps) or an IEEE 802.3u 100BaseTX (100 Mbps) Ethernet connection.
- MII receptacle: a 40-pin, media independent interface (MII) that provides additional flexibility for making Ethernet connections. The pinout of this standard 40-pin receptacle is defined by the IEEE 802.3u standard.

Note The RJ-45 and MII receptacles on the GRP faceplate represent two physical connection options for *one* Ethernet interface; therefore, you can use *either* the MDI RJ-45 connection *or* the MII connection, but not both simultaneously.

Performance Route Processor

Each Cisco 12012 GSR has one main system (or route) processor. The route processor (RP) processes the network routing protocols and distributes updates to the Cisco Express Forwarding (CEF) tables on the line cards. The RP also performs general maintenance functions, such as diagnostics, console support, and line card monitoring.

Two types of RPs are available for the Cisco 12012 GSR:

- Gigabit Route Processor (GRP)
- Performance Route Processor (PRP)

When not explicitly specified, this document uses the term route processor (RP) to indicate either the GRP or the PRP.

Note If you install a second, redundant RP, it must be of the same type as the primary RP.

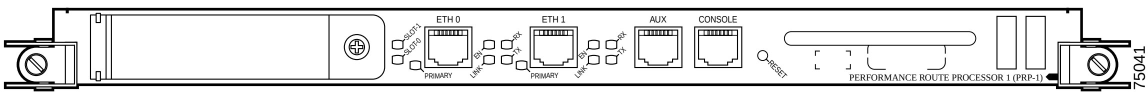
The section describes the Performance Route Processor (PRP) and includes the following information:

- PRP Memory Components
- System Status LEDs
- Soft Reset Switch
- PCMCIA Slots
- Asynchronous Serial Ports
- Ethernet Port

If you have a GRP, see the Gigabit Route Processor section.

Figure 1-11 shows the front panel view of the PRP.

Figure 1-11 Performance Route Processor (Front Panel View, Horizontal Orientation Shown)



The PRP is available as Product Number PRP-1=, which includes one PRP with 512 MB of synchronous dynamic random-access memory (SDRAM) and one 64-MB advanced technology attachment (ATA) Flash disk.

The primary functions of the PRP are as follows:

- Downloading the Cisco IOS software to all of the installed line cards at power up
- Providing a console (terminal) port for router configuration
- Providing an auxiliary port for other external equipment (such as modems)
- Providing two IEEE 802.3, 10/100-megabits-per-second (Mbps) Ethernet ports for Telnet functionality
- Running routing protocols
- Building and distributing routing tables to line cards
- Providing general system maintenance functions
- Communicating with line cards either through the switch fabric or through the maintenance bus (MBus)

  The MBus connection allows the PRP to download a system bootstrap image, collect or load diagnostic information, and perform general, internal system maintenance operations. The switch fabric connection is the main data path for routing table distribution as well as for packets that are sent between line cards and the PRP.

The PRP contains the following components:

- Motorola PowerPC 7450 central processing unit (CPU). The CPU runs at an external bus clock speed of 133 MHz and an internal clock speed of 667 MHz.

- Up to 2 GB of SDRAM on two PC133-compliant, dual in-line memory modules (DIMMs). 512 MB of SDRAM is the default shipping configuration. SDRAM is field replaceable.
- Two MB of SRAM for secondary CPU cache memory functions. SRAM is *not* user configurable or field replaceable.
- Two MB of NVRAM. NVRAM is *not* user configurable or field replaceable.
- Additional memory components used by the system, including onboard Flash memory and up to two Flash memory cards.
- Air-temperature sensors for environmental monitoring.

The Cisco IOS software images that run the Cisco 12000 series Internet Router system are stored in Flash memory. Two types of Flash memory ship with the PRP:

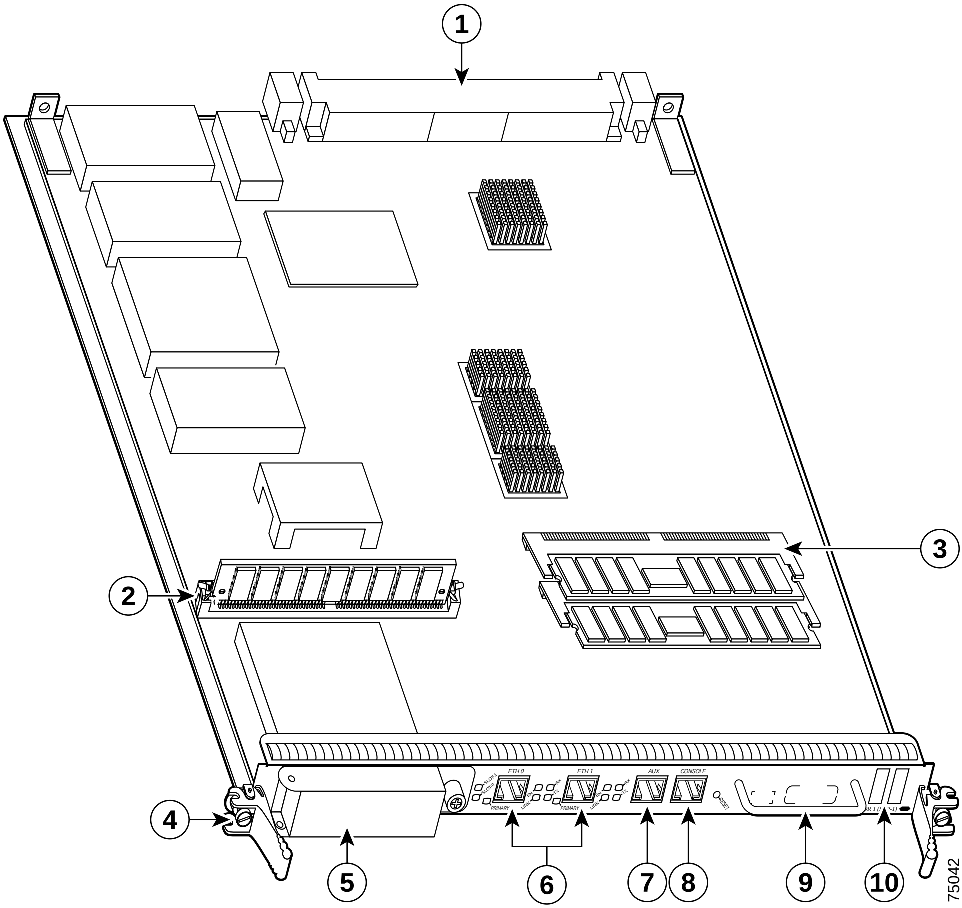
1. Onboard Flash memory — Ships as a single in-line memory module (SIMM). This Flash memory contains the Cisco IOS boot image (bootflash) and is not field replaceable.
2. Flash disk— The PRP ships with a Flash disk that can be installed in either Flash disk slot. (See Figure 1-12.) The Flash disk contains the Cisco IOS software image.

Storing the Cisco IOS images in Flash memory enables you to download and boot from upgraded Cisco IOS software images remotely, or from software images that reside in PRP Flash memory.

Cisco 12000 series Internet Routers support downloadable system software for most Cisco IOS software upgrades. This enables you to remotely download, store, and boot from a new Cisco IOS software image. The Cisco IOS software runs from within the PRPs SDRAM.

Figure 1-12 shows the locations of the various hardware components on the PRP.

Figure 1-12 PRP (Horizontal Orientation)



1	Backplane connector	**6**	Ethernet ports
2	Flash SIMM (Socket number P3)	**7**	Auxiliary port
3	SDRAM DIMMs Bank 1 - Socket number U15 Bank 2 - Socket number U18	**8**	Console port
4	Ejector lever	**9**	Handle
5	Flash disk slots (covered)	**10**	Display LEDs

PRP Memory Components

Table 1-4 lists the memory components on the PRP.

Table 1-4 PRP Memory Components

Type	Size	Quantity	Description
SDRAM[1]	512 MB, 1 GB, or 2 GB	1 or 2	512-MB and 1-GB DIMMs (based on desired SDRAM configuration) for main Cisco IOS software functions
SRAM[2]	2 MB (fixed)	—	Secondary CPU cache memory functions
NVRAM[3]	2 MB (fixed)	1	System configuration files, register settings, and logs
Flash memory	64 MB SIMM[4]	1	Cisco IOS boot image (bootflash), crash information, and other user-defined files
	Flash disks[5]	1 or 2	Cisco IOS software images, system configuration files, and other user-defined files on up to two Flash disks
Flash boot ROM	512 KB	1	Flash EPROM for the ROM monitor program boot image

1. Default SDRAM configuration is 512 MB. Bank 1 (U15) must be populated first. You can use one or both banks to configure SDRAM combinations of 512 MB, 1 GB, or 2 GB. 1.5-GB configurations are not supported.
2. SRAM is not user configurable or field replaceable.
3. NVRAM is not user configurable or field replaceable.
4. Flash memory SIMM is not user configurable or field replaceable.
5. ATA Flash disks and Type I and Type II linear Flash memory cards are supported. See the "Flash Memory" for Flash disk information.

Note If a single DIMM module is installed, it must be placed in bank 1 (U15).

SDRAM

SDRAM stores routing tables, protocols, and network accounting applications, and runs the Cisco IOS software. The default PRP configuration includes 512 MB of error checking and correction (ECC) SDRAM. DIMM upgrades of 512 MB and 1 GB are available. You cannot mix memory sizes. If two DIMMS are installed, they must be the same memory size.

Caution Cisco Systems strongly recommends that you use only Cisco-approved memory. To prevent memory problems, SDRAM DIMMs must be +3.3VDC, PC133-compliant devices. Do not attempt to install other devices in the DIMM sockets.

SRAM

SRAM provides 2 MB of parity-protected, secondary CPU cache memory. Its principal function is to act as a staging area for routing table updates and for information sent to and received from line cards. SRAM is *not* user configurable and *cannot* be upgraded in the field.

NVRAM

NVRAM provides 2 MB of memory for system configuration files, software configuration register settings, and environmental monitoring logs. This information is backed up with built-in lithium batteries that retain the contents for a minimum of 5 years. NVRAM is not user configurable and cannot be upgraded in the field.

Flash Memory

Flash memory allows you to remotely load and store multiple Cisco IOS software and microcode images. You can download a new image over the network or from a local server and then add the new image to Flash memory or replace the existing files. You then can boot the routers either manually or automatically from any of the stored images.

Flash memory also functions as a Trivial File Transfer Protocol (TFTP) server to allow other servers to boot remotely from stored images or to copy them into their own Flash memory. The onboard Flash memory (called *bootflash)* contains the Cisco IOS boot image, and the Flash disk contains the Cisco IOS software image. A 64-MB ATA Flash disk ships by default with the PRP. Table 1-5 lists the supported Flash disk sizes and their Cisco product numbers.

Table 1-5 Supported Flash Disk Sizes and Product Numbers

Flash Disk Size[1]	Product Number
64 MB[2]	MEM-12KRP-FD64=
128 MB	MEM-12KRP-FD128=
1 GB	MEM-12KRP-FD1G=

1. Standard Type 1 and Type 2 linear Flash memory cards also are supported, although they may not have the capacity to meet the requirements of your configuration.
2. 64-MB ATA Flash disk is the default shipping configuration.

System Status LEDs

The sections describes the two types of system status LEDs used on the PRP: LED indicators and alphanumeric LED displays.

The device or port activity indicators consist of the following functional groups:

- Two Flash disk activity LEDs (labeled SLOT-0 and SLOT-1)—1 LED per Flash disk slot: these go on when the slot is accessed.
- Four RJ-45 Ethernet port LEDs (labeled LINK, EN, TX, and RX): used in conjunction with each of the RJ-45 Ethernet connectors. Each connector includes a set of 4 LEDs that indicate link activity (LINK), port enabled (EN), data transmission (TX), and data reception (RX).
- Two Ethernet connection LEDs (labeled PRIMARY): these two LEDs, when on, identify which of the two Ethernet connections is selected. Since both ports are supported on the PRP, the LED on port ETH0 is always on. The ETH1 LED goes on when it is selected.

The alphanumeric display LEDs are organized as two rows of four characters each and are located at one end of the card. These LEDs provide system status and error messages that are displayed during and after the boot process. The boot process and the content displayed are controlled by the PRPs MBus module software.

At the end of the boot process, the LEDs are controlled by the Cisco IOS software (via the MBus), and the content displayed is designated by the Cisco IOS software.

The alphanumeric display LEDs provide information about the following:

- Status of the PRP
- System error messages
- User-defined status and error messages

Note A complete, descriptive list of all system and error messages is located in the *Cisco IOS System Error Messages* publications.

Soft Reset Switch

The soft reset switch causes a nonmaskable interrupt (NMI) and places the PRP in ROM monitor mode. When the PRP enters ROM monitor mode, its behavior depends on the setting of the PRP software configuration register. (For more information on the software configuration register, refer to the Configuring the Software Configuration Register section in Chapter 4) For example, when the boot field of the software configuration register is set to 0x0, and you press the NMI switch, the PRP remains at the ROM monitor prompt (`rommon>`) and waits for a user command to boot the system manually. But if the boot field is set to 0x1, the system automatically boots the first IOS image found in the onboard Flash memory SIMM on the PRP.

Caution The soft reset (NMI) switch is *not* a mechanism for resetting the PRP and reloading the IOS image. It is intended for software development use. To prevent system problems or loss of data, use the soft reset switch only on the advice of Cisco service personnel.

Access to the soft reset switch is through a small opening in the PRP faceplate. To press the switch, you must insert a paper clip or similar small pointed object into the opening.

Flash Disk Slots

The PRP includes two Flash disk (PCMCIA) slots. Either slot can support an ATA Flash disk or a Type 1 or Type 2 linear Flash memory card. The PRP ships by default with one 64-MB ATA Flash disk.

Note The PRP only supports +5VDC Flash disk devices. It does *not* support +3.3VDC PCMCIA devices.

All combinations of different Flash devices are supported by the PRP. You can use ATA Flash disks, Type 1 or Type 2 linear Flash memory cards, or a combination of the two. Each Flash disk slot has an ejector button for ejecting a card from the slot.

Note Type 1 and Type 2 linear Flash memory cards may not have the capacity to meet the requirements of your configuration.

Asynchronous Serial Ports

The PRP has two asynchronous serial ports, the console and auxiliary ports. These allow you to connect external serial devices to monitor and manage the system. Both ports use RJ-45 receptacles.

The console port provides a data circuit-terminating equipment (DCE) interface for connecting a console terminal. The auxiliary port provides a data terminal equipment (DTE) interface and supports flow control. It is often used to connect a modem, a channel service unit (CSU), or other optional equipment for Telnet management.

Ethernet Ports

The PRP includes two Ethernet ports, both using an 8-pin RJ-45 receptacle for either IEEE 802.3 10BASE-T (10 Mbps) or IEEE 802.3u 100BASE-TX (100 Mbps) connections.

Note The transmission speed of the Ethernet ports is auto-sensing by default and is user configurable.

Switch Fabric of the Cisco 12008

The heart of the Cisco 12008 is the switch fabric circuitry, which provides synchronized gigabit speed interconnections between the line cards and the RP. The switch fabric circuitry for the router is incorporated into two cards:

- Clock and scheduler card (CSC)—One CSC installed in the upper card cage is a standard (required) router component. The CSC represents one plane of switch fabric in the router. This card is described in greater detail in the section entitled "Clock and Scheduler Card."
- Switch fabric card (SFC)—You can install a set of three optional SFCs in the lower card cage to increase its switching (data-handling) capacity). Each SFC card represents one plane of switch fabric in the router. This card is described in greater detail in the section entitled "Switch Fabric Cards."

To achieve a fully redundant switch fabric with a switching capacity of 40 Gbps, you can install two CSCs and three SFCs in the router; the second CSC provides redundancy of CSC functions, as well as redundant switch fabric in the event of CSC or SFC failure.

Each CSC or SFC supports an OC-12 switching rate for the router (622 Mbps). By adding the set of three optional SFC cards, you can increase the switching capacity of the router to an OC-48 rate (2.4 Gbps).

Table 1-6 lists the switch fabric bandwidth and the switch card configurations needed to support an OC-12 switching rate or an OC-48 switching rate.

Table 1-6 Switch Fabric Configurations

Switch Fabric Bandwidth	Number of CSCs	Number of SFCs	Planes of Switch Fabric
OC-12 nonredundant	1[1]	0	1
OC-12 redundant	2	0	2
OC-48 nonredundant	1	3	4
OC-48 redundant	2	3	5

1. A CSC is a required router component.

A minimally configured router (one with a single CSC and no SFCs) supports an OC-12 data rate, but provides no redundancy of CSC functions. Adding a second CSC to a system, as well as the three optional SFCs, has the following effects:

- Increases the router's bandwidth from an OC-12 rate to an OC-48 rate.
- Increases the number of planes of switch fabric available to the router from one to five (with the fifth serving as a redundant plane in the event of failure of a CSC or SFC.
- Provides full redundancy of CSC functions, such as the following:
  - System clocking
  - Resource allocation
  - Scheduling
- Provides full redundancy in the router's fan power and alarm functions.

Clock and Scheduler Card

The CSC is a multi-function circuit board that can be installed in one or both of two reserved slots (CSC0 and CSC1) in the middle of the upper card cage (see Figure 1-2). The standard router configuration requires one CSC in either slot CSC0 or slot CSC1. If you configure your router with a single CSC, it is recommended that you install it in CSC1.

Each CSC is mounted on its own card carrier and incorporates an onboard power supply that takes the –48 VDC supplied by the backplane and converts it into the 3.3 VDC operating voltage required by the card's electronics.

As a multi-function board, the CSC provides the following system services:

- Provides one plane of switch fabric for the router (see the section below entitled "Switch Fabric in the Cisco 12008").
- Serves as a switch fabric controller card for the router (see the section below entitled "Switch Fabric Controller Functions of the CSC").
- Serves as an alarm monitoring facility for the router (see the section below entitled "Housekeeping and Alarm Monitoring Functions of the CSC").
- Provides onboard power for its own electronic circuitry, as well as power and control functions for the fan trays (see the section below entitled "Board Power and Fan Tray Power Functions of the CSC").

These functions are described in the following sections.

Switch Fabric in the Cisco 12008

A *switch plane* in the router consists of one OC-12-rate crossbar in the backplane that enables each line card slot in the router to be connected logically to every other line card slot. Line cards installed in any combination of slots in the upper card cage can communicate with each other by means of the router's switch fabric.

The *switch fabric* of the router constitutes the totality of the possible data paths that can be established through the router. The magnitude of the router's switch fabric (and, hence, its data- carrying capacity) is related directly to the number of switch planes that are made available to the router for data-handling purposes. By installing a second CSC and/or the optional set of three SFCs in the router, you can increase the number of *switch planes* present in the router, thereby increasing the magnitude of the router's overall *switch fabric*.

Table 1-7 outlines the possible configurations of CSCs and SFCs and the router switching capacity that results from these configurations.

Table 1-7 Switch Planes Provided by Switch Cards

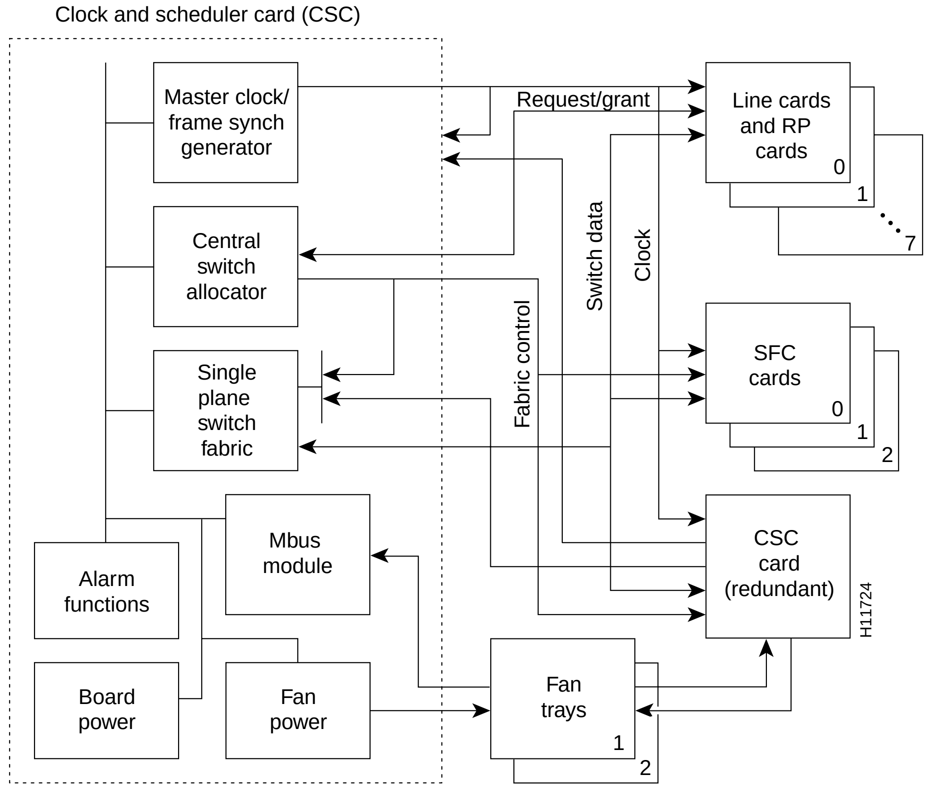
Switch Card Type	Availability	Number of Switch Planes	Description
One CSC	Standard	1	A single CSC supports an OC-12 data rate for the router, but provides no redundancy in the router's switch fabric.
Second CSC	Optional	1	A second CSC supports an OC-12 data rate for the router and also provides a redundant plane of switch fabric. If one of the CSCs fails, a fault recovery cutover to the surviving CSC occurs, not only to maintain the router's OC-12 data rate, but also to preserve the system services peculiar to the CSC.
Three SFCs	Optional	3	The optional set of three SFCs enables the router to support an OC-48 data rate. In an OC-48 rate[1] system, no redundancy exists in the switch fabric. However, if a switch plane failure occurs in a fully-redundant[2] system, a CSC can take over the functions of either a failed CSC or a failed SFC, not only to maintain the router's OC-48 data rate, but also to preserve the essential CSC system services.

1. Router equipped with one CSC and three SFCs.
2. Router equipped with two CSCs and three SFCs.

Switch Fabric Controller Functions of the CSC

In addition to providing one plane of switch fabric for the router, the CSC provides numerous other functions and services essential to router operations. Figure 1-13 illustrates the primary functional elements of the CSC.

Figure 1-13 Block Diagram of the CSC



The major functions of each element of the CSC are summarized briefly in the following paragraphs.

- Master clock generator—This function on the CSC provides a clock source to the RP, all installed switch cards (including the SFCs and a redundant CSC), and all installed line cards. The master clock generator synchronizes the transfer of data through the router's switch fabric.

In a redundant CSC configuration, the phase of the master clock generator on one card is synchronized with that of the other card. If either clock drifts, the master clock generators on both cards remain tightly aligned.

Should one of the CSCs fail, the phase lock between the two master clock sources is aborted within nanoseconds, enabling the surviving CSC clock to remain stable and take over master clock duties.

- Frame synchronization generator—This function on the CSC provides a periodic signal to the line cards and switch cards to control data flow.

  In a redundant CSC configuration, either CSC can adopt the frame synchronization phase of the other to ensure phase alignment. The line cards can switch between frame synchronization masters without disruption.

  If the frame synchronization function on one CSC fails, cutover to the surviving frame synchronization generator on the other card occurs within nanoseconds, sustaining system operations.

- Central switch allocator and scheduler—This function on the CSC allocates switching resources to line cards and schedules (arbitrates) the flow of data through the router’s switch fabric.

  Switch arbitration begins with a set of requests from line cards to send data through the router’s switch fabric. The scheduler plans a set of paths through the switch fabric to carry as much data as possible per unit of time. At the next available time unit, the request to send data is granted, and the data is sent to its destination. The next round of switch arbitration (scheduling) then begins.

  The scheduler also sends switch fabric control information to each switch plane to create appropriate data paths through the switch fabric. When the new data paths are configured into the switch fabric, data begins to flow toward the destination line card(s).

  The central switch allocator and scheduler accepts data transport requests from all line cards (including the RP), generates grants (accepted data transport requests), and drives all planes of the router’s switch fabric.

- Single plane switch fabric—The CSC’s single-plane switch fabric provides an OC-12 rate of switching capacity for the router. This switch fabric plane operates under control of the CSC’s central switch allocator and scheduler.

This single switch plane of the CSC can be used alone in a minimum router configuration, or it can be used in combination with another CSC and the three optional SFCs for full switching redundancy. In the latter case, the per line-card slot bandwidth of the router is increased from an OC-12 rate to an OC-48 rate, and the second CSC provides redundancy.

If any one switch plane fails in a fully redundant switch fabric, the failed plane is shut down, and the router's full data bandwidth is carried by the surviving planes. The fault recovery cutover to another viable switch plane typically occurs without loss of data, because the data path defect is detected while redundancy information is still available, thus enabling error packets to be repaired "on the fly."

Housekeeping and Alarm Monitoring Functions of the CSC

The section describes the following housekeeping and alarm monitoring facilities built into the CSC:

- MBus module— The MBus module on the CSC is a microprocessor-based subassembly that provides housekeeping services required during router power up and initialization. It also supports the alarm monitoring LEDs on the CSC faceplate, as described in the following section.

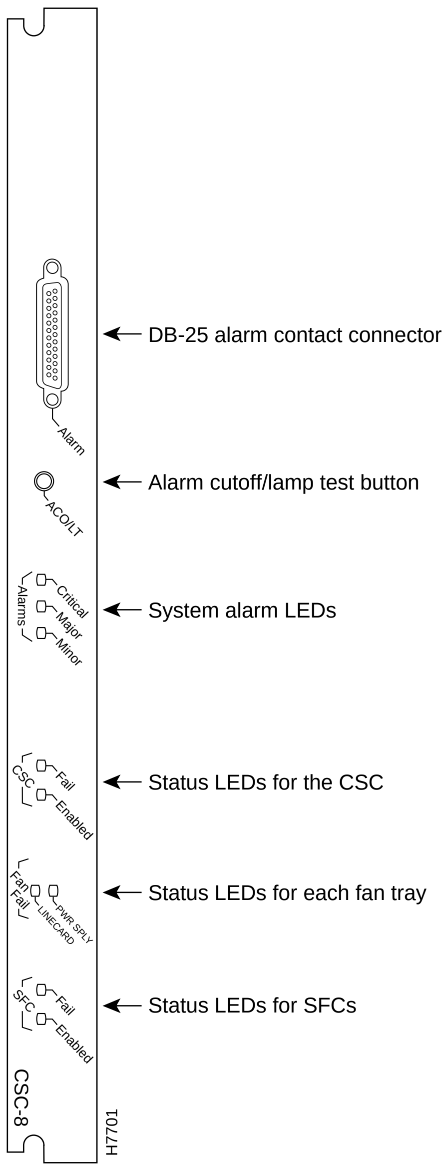
  The MBus module on the CSC operates partly autonomously and partly under the control of the master MBus module on the RP.

  A failed MBus module on the CSC is detected by an MBus polling algorithm running in the background on the RP.

  A failed MBus module detected by this polling algorithm in a redundant CSC configuration causes the master MBus module to execute an *administrative cutover* to the MBus module on the surviving CSC. This cutover is accomplished with no disruption of normal system operations.

- Alarm monitoring and status functions—The CSC supports the router's alarm and status monitoring functions. These functions are described in the following paragraphs. Figure 1-14 shows the location of the alarm contact connector and the various LEDs on the CSC faceplate through which the system accomplishes its alarm monitoring and status reporting functions.

Figure 1-14 CSC Alarm Monitoring Facilities



— DB-25 alarm contact connector—A female DB-25 D-sub connector incorporated into the CSC faceplate enables you to attach an external alarm monitoring facility to the router, thus supporting a telco style of handling alarm conditions in the router.

  The alarm signals sent to this DB-25 connector are identical in function to those sent to the system LEDs on the CSC faceplate (see the following section entitled "System Alarm LEDS").

  Any alarm condition in the router that activates one of the system alarm LEDs on the CSC faceplate also energizes an appropriate CSC relay, causing a corresponding signal to be sent to the DB-25 connector. If an external alarm monitoring facility is attached to the DB-25 connector, this signal activates the appropriate external audible or visible alarm.

  An external audible alarm can be reset by clearing the condition that caused the alarm or by pressing the alarm cutoff reset/lamp test (ACO/LT) button on the CSC faceplate (see the following discussion about the ACO/LT button). A visual alarm, however, can be reset only by resolving the problem that caused the alarm condition.

  Only safety extra-low voltage (SELV) external alarm circuits can be connected to the DB-25 connector.

— One external closure sense line, enabling the router to monitor an external event, such as the opening of a cabinet door or the activation of an alarm in associated equipment.

— Alarm cutoff reset/lamp test (ACO/LT) button—If you equip your system with an external alarm monitoring facility, a visible indication can be provided, and/or an audible alarm can be sounded, to immediately notify site personnel of an alarm condition in the router.

  An audible alarm generated by the system continues to sound until you either clear the alarm condition itself or press the ACO/LT button to silence the alarm. Merely pressing this button does not resolve the alarm condition.

  You can test the operability of the LEDs on the CSC(s), the SFC(s), and the power supply(ies), by pressing the ACO/LT button at any time. Doing so causes the LEDs on all these router components to remain lit as long as you hold down the button. However, the LEDs on the SFCs are visible only when the air filter assembly is removed.

In a system equipped with two CSCs, pressing the ACO/LT button on one CSC is equivalent to pressing this button on either CSC or both CSCs.

— System alarm LEDs—Three system LEDs, labeled critical, major, and minor, are incorporated into the CSC faceplate (see Figure 1-14) to signal the existence of alarm conditions detected in the router by the system's environmental monitoring circuitry.

  During an alarm condition, one of these LEDs goes on to indicate the severity of the detected fault. During a critical alarm, the top LED (Critical) on the CSC faceplate indicates red; similarly, during a major alarm, the middle LED (Major) on the CSC faceplate also indicates red, signifying an alarm condition of lesser severity; finally, during a minor system alarm, the bottom LED (Minor) indicates amber, signifying an alarm condition of least severity.

  At the same time that one of these LEDs goes on to signal the alarm event, an associated alarm relay on the CSC is closed, sending a corresponding signal to the DB-25 alarm contact connector on the CSC faceplate.

  An alarm condition detected in a redundant CSC configuration causes the appropriate relays on both CSCs to close, activating the visible and audible alarm functions of the DB-25 connector on each card.

  When the fault condition is resolved, MBus software running in the GRP automatically clears the fault indication by communicating with the master MBus module, which, in turn, communicates with the MBus module on each circuit board.

— CSC Status LEDs—Two LEDs on the CSC faceplate, the top one labeled FAIL and the bottom one labeled ENABLED, indicate the operational status of the CSC.

— FAN FAIL Status LEDs for each fan tray—Two side-by-side LEDs on the CSC faceplate indicate the operational status of the fan trays.

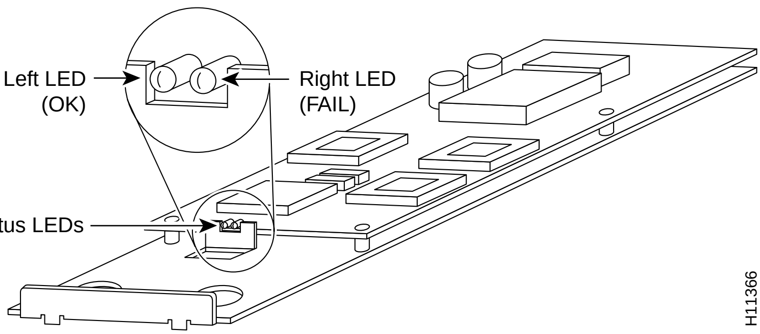
  The LINECARD LED on the left pertains to the card cage fan tray, and the PWR SPLY LED on the right pertains to the power supply fan tray.

— SFC Status LEDs—Two LEDs at the bottom of the CSC faceplate, the top one labeled FAIL and the bottom one labeled ENABLED, indicate the operational status of the SFCs in the lower card cage (behind the air filter assembly).

If the FAIL LED goes on, it indicates that one of the three SFCs in the lower card cage has failed. To determine which of the SFCs has failed, you must remove the air filter assembly and examine the status of the LEDs on each SFC.

Two side-by-side LEDS behind a vertical tab near the center of the SFC (see Figure 1-15) indicate the operational status of the card.

Figure 1-15 Status LEDs on an SFC



Board Power and Fan Tray Power Functions of the CSC

DC-DC converters on the CSC provide power for its own circuitry, as well as power for the fan trays. These functions are described briefly in the following sections.

- Board power—A DC-DC converter on the CSC takes the –48 VDC being delivered to the card from the backplane and converts it into the +3.3 VDC required to drive the card's electronic circuity.

  No redundancy is built into the CSC for the +3.3 VDC operating voltage; if the DC-DC converter fails to deliver this voltage, the card shuts down, at which time the redundant CSC, if installed, takes over to maintain normal system operations.

  However, in a nonredundant CSC configuration, the failure of the installed CSC causes the entire system to shut down.

- Fan tray power—The Cisco 12008 router contains two fan trays (see Figure 1-2).

  Control of fan power is initiated at system startup, with the fans running at a slow rate for normal operations. Such operation minimizes fan noise, wear, and power consumption. A DC-DC converter on the CSC provides +20 VDC for slow fan operation and +25 VDC for fast fan operation when an overtemperature condition is sensed in the router.

  Periodically, the master MBus module on the GRP polls the MBus module on each circuit board to determine whether router components are cool enough to warrant keeping the fans running at their minimum rate. If they are not, the master MBus module directs the MBus module on the CSC to increase the operating voltage being delivered to the fan trays, causing the fans to run faster, thus increasing the volume of air being circulated through the router.

  Each fan is monitored separately for failure. A failed fan is not “shut off” in the usual sense; rather, a current-limiting feature in the faulty fan prevents it from interfering with the operation of other fans.

  On failure of a fan in either the card cage fan tray or the power supply fan tray, the CSC increases the voltage being delivered to the surviving fans, causing them to run faster to compensate for the failed fan.

Cisco 12000 Series Line Cards

The Cisco 12008 comes equipped with the number and type of line cards that you ordered already installed. Up to seven Cisco 12000 series line cards can be installed in the router to support a variety of physical network media.

The line cards can be installed in upper card cage slots 0 through 3 and slots 4 through 7. Note, however, that it is recommended that the GRP be installed in slot 0. Line cards interface to each other and the GRP through the router’s switch fabric.

The following types of line cards are available for use with the Cisco 12008:

- Quad OC-3c/STM-1c POS—4 ports
- OC-12c/STM-4c POS—1 port
- OC-12c/STM-4c ATM—1 port

These cards provide the interfaces to the router's external physical media. They exchange packet data with each other by way of the router's switch fabric.

Caution Any unoccupied slot in the upper card cage must have a blank filler panel installed for EMI compliance and to ensure proper air flow through the router enclosure.

A vertical cable-management bracket attached to the faceplate of each line card enables you to neatly arrange the network interface cables for connection to the individual ports on the line card. The cable-management system is described in detail in the section entitled "Cable-Management System" on page 8.

The online insertion and removal (OIR) capability of the Cisco 12008 enables you to remove and replace a line card while the system remains powered up and operational.

The Cisco 12000 series line cards available for use with the Cisco 12008 router are described briefly in the following sections.

Quad OC-3c/STM-1c POS Line Card

The Quad OC-3c/STM-1c POS line card provides the Cisco 12008 router with four independent Packet-Over-SONET (POS) ports on a single card. The card interfaces with the router's switch fabric and provides four OC-3c/STM-1c SC-duplex SONET connections. These connections are concatenated, which provides for increased efficiency by eliminating the need to partition the bandwidth.

Figure 1-16 shows a high-level block diagram of the Quad OC-3c/STM-1c POS line card; Figure 1-17 shows a front view of the card.

Figure 1-16 Block Diagram of the Quad OC-3c/STM-1c POS Line Card

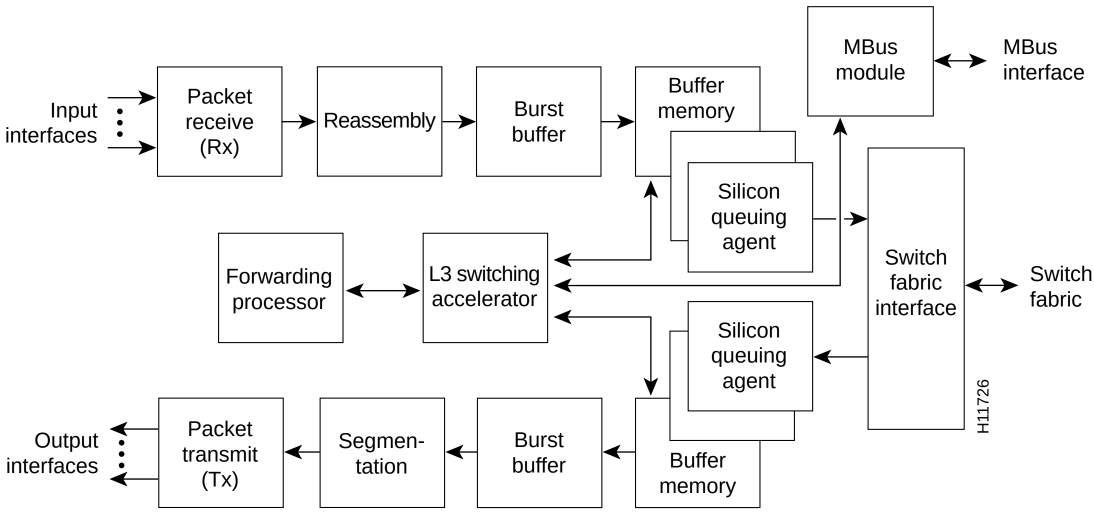
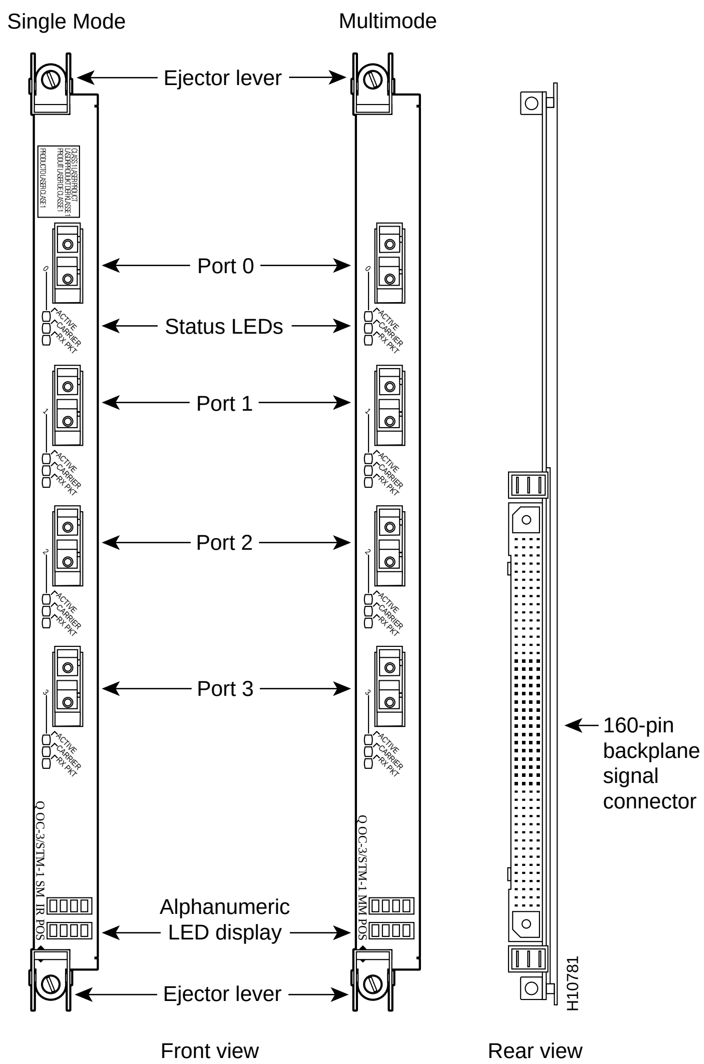


Figure 1-17 Quad OC-3c/STM-1c POS Line Card



Each Quad OC-3c/STM-1c POS line card incorporates the following major components:

- Transceivers—The single-mode intermediate reach transceiver provides a full-duplex, 155-Mbps, 1300-nm, laser-based SONET/SDH-compliant interface. The multimode transceiver provides a full-duplex, 155-Mbps, 1300-nm, LED-based SONET/SDH compliant interface.

  The SONET specification for fiber-optic transmission defines two types of fiber: single mode and multimode. Signals can travel farther through single mode fiber than through multimode fiber.

  The maximum distance for single-mode installations is determined by the amount of light loss in the fiber path. Good quality single-mode fiber with very few splices can carry an OC-3c/STM-1c signal 9.3 miles (15 km) or more; good quality miltimode fiber can carry a signal up to 1.3 miles (2 km).

- Burst buffers—The Quad-OC3c/STM-1c contains four 128-KB burst buffers. The burst buffer prevents the dropping of packets during instantaneous increases in the number of back-to-back small packets being transmitted at OC-3 line rates.

  Burst buffers are used to achieve high throughput while smoothing out the arriving packet burst for the Layer 3 switch processor.

- Buffer memory—The silicon queuing engine controls the placement of IP packets in buffer memory as well as their removal from buffer memory. The default packet buffer memory is 32 MB, which includes 16 MB of receive (Rx) buffers and 16 MB of transmit (Tx) buffers.

  The buffer memory can be configured to support up to 64 MB of receive buffers and up to 64-MB of transmit buffers. The buffers can support delays comparable to the longest round trip delays measured in the Internet at OC-3c/STM-1c line rates.

- Layer 2 switching accelerator—The Layer 2 switching accelerator assists the forwarding processor. It is a specially designed application-specific integrated circuit (ASIC) that optimizes access to the Layer 2 and Layer 3 information within each packet. At very high line rates, this access process must be executed as rapidly as possible, which is why an ASIC is dedicated to the process.

- Forwarding processor—A forwarding processor makes forwarding decisions based on the information in the Cisco Express Forwarding (CEF) table and the Layer 2 and Layer 3 information in the packet. The GRP constantly updates forwarding information in the forwarding table based on the latest information in the routing table.

Once the forwarding decision has been made, the silicon queuing engine is notified by the forwarding processor, and the silicon queuing engine places the packet in the proper queue.

This partitioning between the Layer 2 switching accelerator and the forwarding processor blends the high throughput of hardware-accelerated forwarding with the flexibility of software-based routing.

- Silicon queuing engine—Each line card has two silicon queuing engines: receive and transmit. The receive engine moves packets from the burst buffer to the switch fabric, and the transmit engine moves packets from the switch fabric to the transmit interface.

  When an incoming IP packet is clocked into the silicon queuing engine, the packet's integrity is verified by a check of the CRC. Next, the silicon queuing engine transfers the IP packet to buffer memory and tells the Layer 3 switching accelerator the location of the IP packet.

  Simultaneously, the silicon queuing engine is receiving forwarding information from the forwarding processor. The forwarding processor tells the silicon queuing engine the virtual output queue where the IP packet is to be placed.

  Each virtual output queue represents an output destination (destination line card). This placement of the IP packets in a virtual output queue is based on the decision made by the forwarding processor. There is one virtual output queue for each line card, plus a dedicated virtual output queue for multicast service.

  The transmit silicon queuing engine moves the packet from the switch fabric to the transmit buffer, and then to the transmit interface.

- Switch fabric interface—The switch fabric interface is the same 1.25-Gbps, full-duplex data path to the switching fabric that is used by the GRP. Once a packet is in the proper queue, the switch fabric interface issues a request to the master clock scheduler on the CSC. The scheduler issues a grant and transfers the packet across the switching fabric.
- Maintenance bus (MBus) module—A maintenance bus (MBus) module on the line card responds to requests from the master MBus module on the GRP. The MBus module on the line card reports temperature and voltage information to the master MBus module. In addition, the MBus module on the line card contains the ID-EEPROM, which stores the serial number, hardware revision level, and other information about the card.

- Cisco Express Forwarding (CEF) memory table—Each line card maintains CEF tables. These tables, derived from routing tables maintained by the GRP, are used by the line card processor in making forwarding decisions.

  Large networks may require more DRAM to support large CEF tables. For information on adding memory to a line card, see the document entitled *Cisco 12000 Series Gigabit Switch Router Memory Replacement Instructions*.

OC-12c/STM-4c POS Line Card

The OC-12c/STM-4c POS line card provides the Cisco 12008 with a single 622-Mbps Packet-Over-SONET (POS) interface. The card provides one OC-12c/STM-4cc SC duplex single-mode or multimode SONET/SDH connection. This connection is concatenated, which provides for increased efficiency by eliminating the need to partition the bandwidth.

Figure 1-18 shows a high-level block diagram of the OC-12c/STM-4c POS line card; Figure 1-19 shows a front view of the card.

Figure 1-18 Block Diagram of the OC-12c/STM-4c POS Line Card

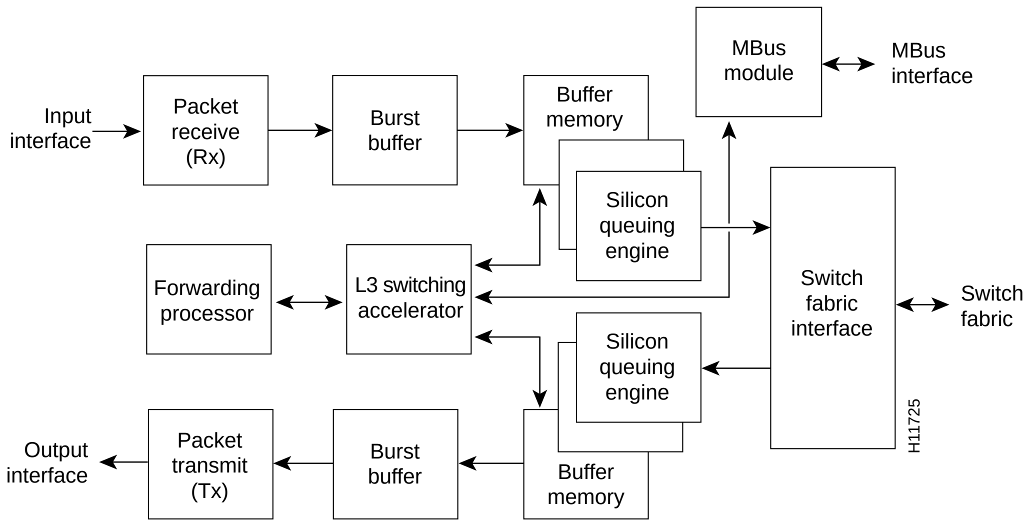
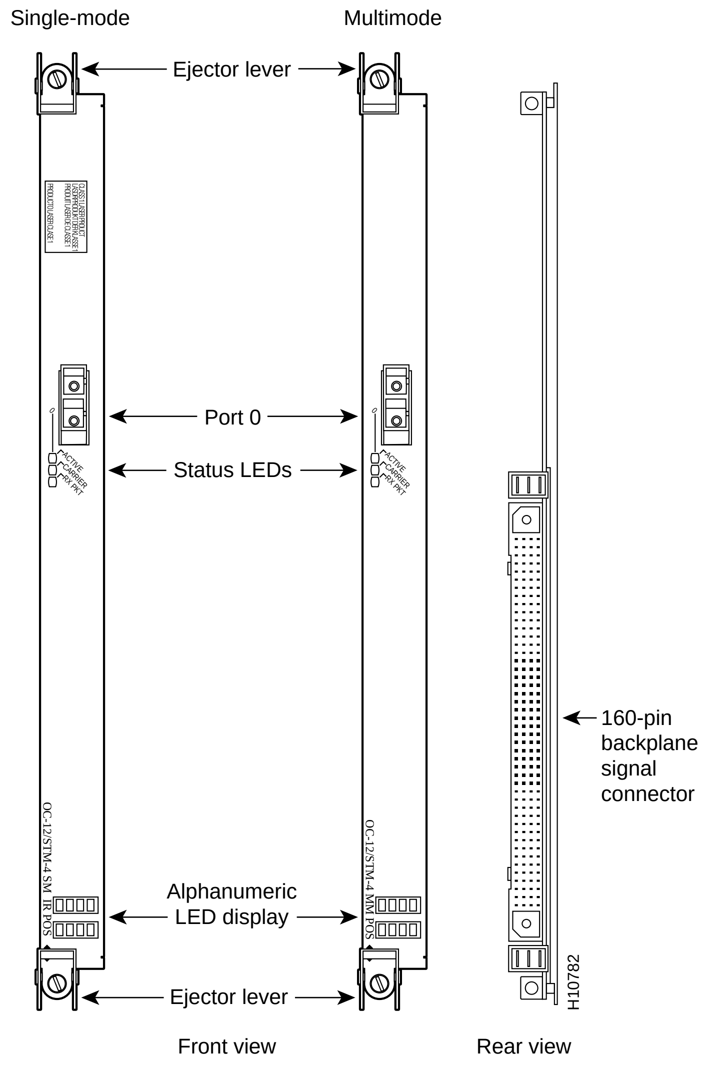


Figure 1-19 OC-12c/STM-4c POS Line Card



Each OC-12c/STM-4c POS line card incorporates the following primary components:

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- Transceivers—The single-mode intermediate reach transceiver provides a full-duplex, 155-Mbps, 1300-nm, laser-based SONET/SDH-compliant interface. The multimode transceiver provides a full-duplex, 155-Mbps, 1300-nm, LED-based SONET/SDH compliant interface.

  The SONET specification for fiber-optic transmission defines two types of fiber: single mode and multimode. Signals can travel farther through single mode fiber than through multimode fiber.

  The maximum distance for single-mode installations is determined by the amount of light loss in the fiber path. Good quality single-mode fiber with very few splices can carry an OC-3c/STM-1c signal 9.3 miles (15 km) or more; good quality miltimode fiber can carry a signal up to 1640 feet (500 m).

- Burst buffers—The burst buffer (512 KB) prevents the dropping of packets during instantaneous increases in the number of back-to-back small packets being transmitted at OC-12c/STM-4c line rates. Burst buffers are used to achieve high throughput while smoothing out the arriving packet burst for the Layer 3 switch processor.

- Buffer memory—The silicon queuing engine controls the placement of IP packets in buffer memory as well as their removal from buffer memory. The default packet buffer memory is 32 MB, which includes 16 MB of receive (Rx) buffers and 16 MB of transmit (Tx) buffers.

  The buffer memory can be configured to support up to 64 MB of receive buffers and up to 64 MB of transmit buffers. The buffers can support delays comparable to the longest round trip delays measured in the Internet at OC-12c/STM-4c line rates

- Layer 2 switching accelerator—The Layer 2 switching accelerator assists the forwarding processor. It is a specially designed application-specific integrated circuit (ASIC) that optimizes access to the Layer 2 and Layer 3 information within each packet. At very high line rates, this access process must be executed as rapidly as possible, which is why an ASIC is dedicated to the process.

- Forwarding processor—A forwarding processor makes forwarding decisions based on the information in the Cisco Express Forwarding (CEF) table and the Layer 2 and Layer 3 information in the packet. The GRP constantly updates forwarding information in the forwarding table, based on the latest information in the routing table.

Once the forwarding processor makes a forwarding decision, it notifies the silicon queuing engine, and the silicon queuing engine places the packet in the proper queue.

This partitioning between the Layer 2 switching accelerator and the forwarding processor blends the high throughput of hardware-accelerated forwarding with the flexibility of software-based routing.

- Silicon queuing engine—Each line card has two silicon queuing engines: receive and transmit. The receive engine moves packets from the burst buffer to the switch fabric, and the transmit engine moves packets from the switch fabric to the transmit interface.

  When an incoming IP packet is clocked into the silicon queuing engine, packet integrity is verified by a CRC check. Next, the silicon queuing engine transfers the IP packet to buffer memory and tells the Layer 3 switching accelerator the location of the IP packet. Simultaneously, the silicon queuing engine is receiving forwarding information from the forwarding processor. The forwarding processor tells the silicon queuing engine the virtual output queue where the IP packet is to be placed.

  Each virtual output queue represents an output destination (destination line card). This placement of the IP packets in a virtual output queue is based on the decision made by the forwarding processor. There is one virtual output queue for each line card, plus a dedicated virtual output queue for multicast service.

  The transmit silicon queuing engine moves the packet from the switch fabric to the transmit buffer, and then to the transmit interface.

- Switch fabric interface—The switch fabric interface is the same 1.25-Gbaud, full-duplex data path to the switching fabric that is used by the GRP. Once a packet is in the proper queue, the switch fabric interface issues a request to the master clock scheduler on the CSC. The scheduler issues a grant and transfers the packet across the switching fabric.

- Maintenance bus (MBus) module—A maintenance bus (MBus) module on the line card responds to requests from the master MBus module on the GRP. The MBus module on the line card reports temperature and voltage information to the GRP master MBus module.

  In addition, the MBus module on the line card contains the ID-EEPROM, which stores the serial number, hardware revision level, and other information about the card.

- Cisco Express Forwarding (CEF) memory table—Each line card maintains CEF tables. These tables, derived from routing tables maintained by the GRP, are used by the line card processor to make forwarding decisions.

  Large networks may require more DRAM to support large CEF tables. For information on adding memory to a line card, see the document entitled *Cisco 12000 Series Gigabit Switch Router Memory Replacement Instructions.*

OC-12c/STM-4c ATM Line Card

The OC-12c/STM-4c ATM line card provides the Cisco 12008 with a 622-Mbps ATM interface. The card interfaces to the router's switch fabric, supports from 10 to 40 Gbps, and provides one OC-12c/STM-4c SC duplex single-mode or multimode SONET/SDH connection. This connection is concatenated, which provides for increased efficiency by eliminating the need to partition the bandwidth.

Figure 1-20 shows a high-level block diagram of the OC-12c/STM-4c ATM line card; Figure 1-21 shows a front view of the card.

Figure 1-20 Block Diagram of the OC-12c/STM-4c ATM Line Card

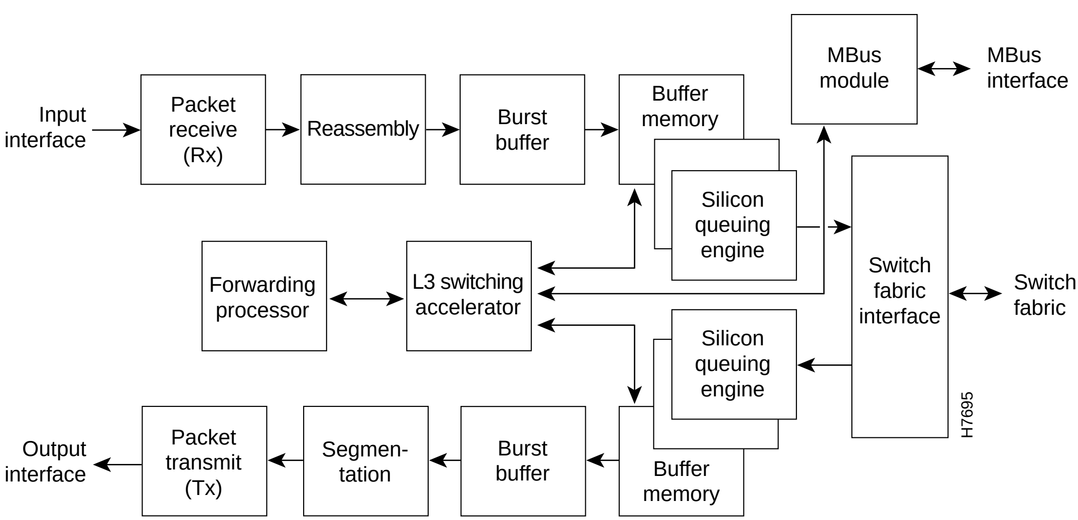
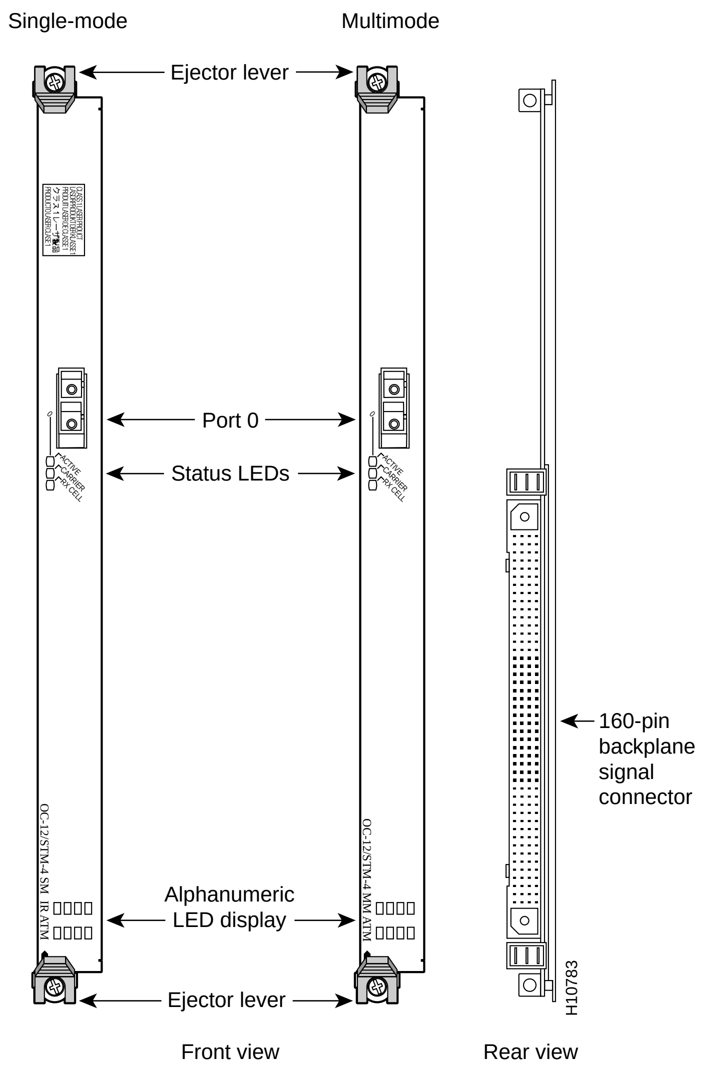


Figure 1-21 Front View of OC-12c/STM-4c ATM Line Card



Each OC-12c/STM-4c ATM line card incorporates the following primary components:

- Reassembly and segmentation—The transceivers support packet reassembly (converting ATM cells to packets) and segmentation (converting packets to ATM cells). The transceivers can handle up to 4000 simultaneous reassemblies (based on an average packet size of 280 bytes). In addition, the reassembly application-specific integrated circuit (ASIC) and the segmentation ASIC support up to 15,000 active virtual circuits.

  The SONET specification for fiber-optic transmission defines two types of fiber: single mode and multimode. Signals can travel farther through single mode fiber than through multimode fiber.

  The maximum distance for single-mode installations is determined by the amount of light loss in the fiber path. Good quality single-mode fiber with very few splices can carry an OC-3c/STM-1c signal 9.3 miles (15 km) or more; good quality miltimode fiber can carry a signal up to 1640 feet (500 m).

- Burst buffers—The burst buffer (4 MB) prevents the dropping of packets during instantaneous increases in the number of back-to-back small packets being transmitted at OC-12 line rates. Burst buffers provide high throughput while smoothing out the arriving packet burst for the Layer 3 switch processor.

- Buffer memory—The silicon queuing engine controls the placement of IP packets in buffer memory as well as their removal from buffer memory. The default packet buffer memory is 32 MB, which includes 16 MB of receive (Rx) buffers and 16 MB of transmit (Tx) buffers. The buffer memory can be configured to support up to 64 MB of receive buffers and 64 MB of transmit buffers. The buffers can support delays comparable to the longest round trip delays measured in the Internet at OC-3/STM-1 line rates.

- Layer 2 switching accelerator—The Layer 2 switching accelerator assists the forwarding processor. It is a specially designed application-specific integrated circuit (ASIC) that optimizes access to the Layer 2 and Layer 3 information within each packet. At very high line rates, this access process must be executed as rapidly as possible, which is why an ASIC is dedicated to the process.

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Once the forwarding decision has been made, the silicon queuing engine is notified by the forwarding processor, and the silicon queuing engine places the packet in the proper queue.

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  When an incoming IP packet is clocked into the silicon queuing engine, the packet's integrity is verified by a CRC check. Next, the silicon queuing engine transfers the IP packet to buffer memory and tells the Layer 3 switching accelerator the location of the IP packet. Simultaneously, the silicon queuing engine is receiving forwarding information from the forwarding processor, while the forwarding processor is telling the silicon queuing engine where the IP packet is to be placed in the virtual output queue.

  Each virtual output queue represents an output destination (destination line card). Placement of the IP packets in a virtual output queue is based on the decision made by the forwarding processor. There is one virtual output queue for each line card, plus a dedicated virtual output queue for multicast service.

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- Maintenance bus (MBus) module—An MBus module on the line card responds to requests from the master MBus module on the GRP. The line card MBus module reports temperature and voltage information to the master MBus module.

  In addition, the MBus module on the line card contains the ID-EEPROM, which stores the serial number, hardware revision level, and other information about the card.

- Cisco Express Forwarding (CEF) memory table—Each line card maintains CEF tables. These tables, derived from routing tables maintained by the GRP, are used by the line card processor to make forwarding decisions.

Large networks may require more DRAM to support large CEF tables. For information on adding memory to a line card, see the document entitled *Cisco 12000 Series Gigabit Switch Router Memory Replacement Instructions*.

Air Filter Assembly

The Cisco 12008 is equipped with a removable air filter that is mounted directly to the router enclosure in front of the lower card cage (see Figure 1-22).

Although the Cisco 12008 will run without an air filter, the air filter should always be present and maintained properly, especially in dirty or dusty environments.

The air filter assembly serves the following purposes:

- Filters the ambient air being draw into the router by the card cage fan tray.
- Prevents EMI radiation from being emitted into the router's environment.

  A metal honeycomb structure built into the air filter assembly provides EMI containment.

You are advised to inspect and clean the air filter at least once a month (or more often in a dusty environment).

Procedures for vacuuming and replacing the air filter are contained in the section entitled "Cleaning the Air Filter" in Chapter 7.

Lower Card Cage and Associated Components

The lower card cage, located directly behind the air filter assembly (see Figure 1-22), houses the card cage fan tray and an optional set of three switch fabric cards (SFCs).

The dimensional characteristics of the SFCs differ markedly from those of the circuit boards in the upper card cage. Three dedicated slots, numbered SFC0, SFC1, and SFC2 as you face the lower card cage, are provided to house the SFCs.

Switch Fabric Cards

The SFCs increase the switching capacity of the Cisco 12008. By adding three SFCs to a router equipped with a *single* CSC, you increase the bandwidth of each line card slot in the router from an OC-12 rate to an OC-48 rate.

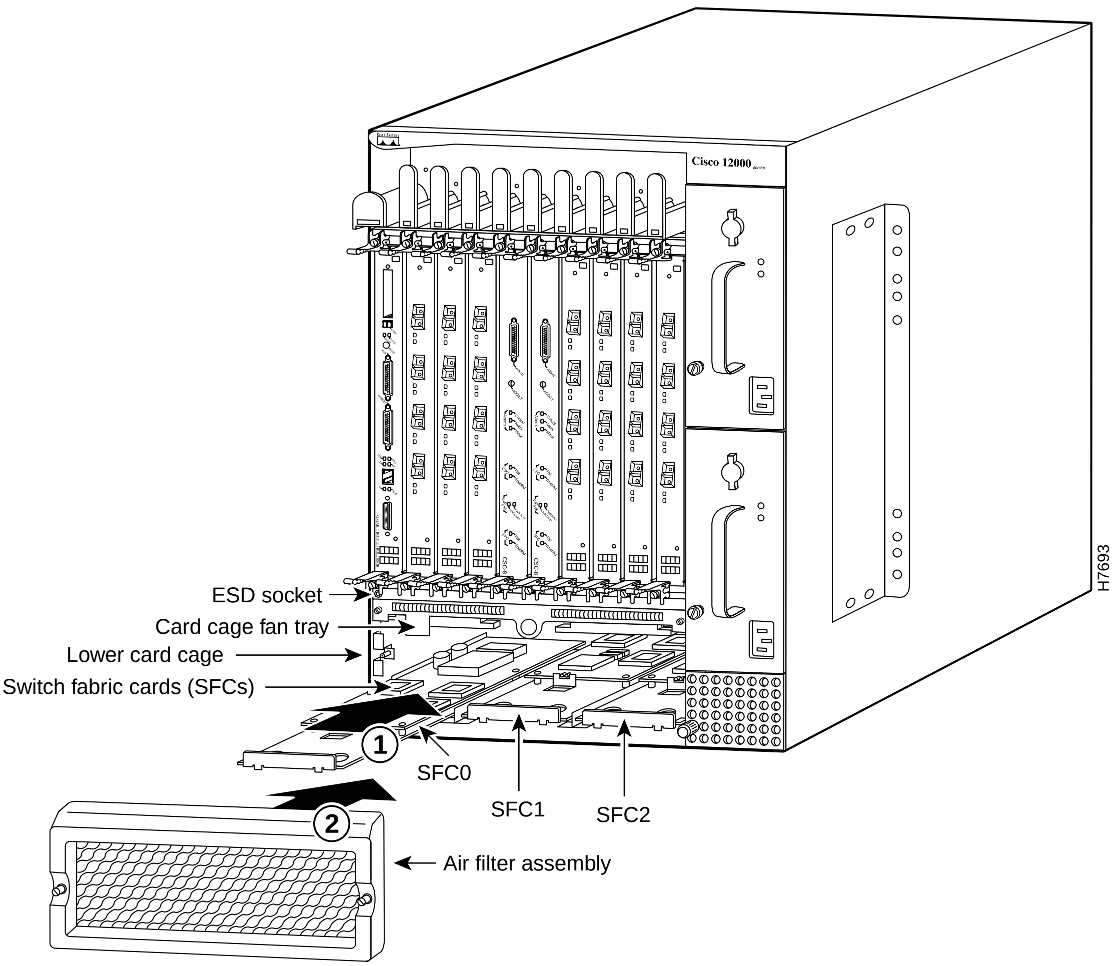
By adding three SFCs to a router equipped with *two* CSCs, you not only increase the bandwidth of each line card slot to an OC-48 rate, but you also provide a fifth (redundant) switch plane so that the router's OC-48 data rate can be maintained even if a switch plane should fail.

In a router with full switch plane redundancy (that is, a router with five available switch planes), five parallel 1.25 Gbaud serial data streams can be transmitted across the backplane to and from the router's line cards. However, only four of the data streams are required for data transmission purposes; the fifth data stream carries error correction information. If an error occurs on one of the parallel data streams, data in error can be recovered through use of the four remaining correct data streams.

You need not install the optional SFCs in a router that uses line cards having an aggregate bandwidth rate of OC-12 or less. In such a system, a single CSC can provide sufficient bandwidth to accomplish all the router's switching and routing functions. Thus, a minimally configured router does not require the optional switching capacity provided by the SFCs. To increase the switching capacity of the Cisco 12008 to the full OC-48 rate, however, you must install the three optional SFCs.

Each SFC is mounted on its own card carrier and incorporates an onboard power supply that takes the –48 VDC supplied by the backplane and converts it into the 3.3 VDC operating voltage required by the card.

Figure 1-22 Components in the Lower Card Cage



The switching fabric of the SFC is identical to that of the CSC. However, the SFCs do not perform any of the system services native to the CSC (see the section entitled “Clock and Scheduler Card” on page 44). The SFC merely augments the switching capacity of the router.

Power Distribution System in the Cisco 12008

In the Cisco 12008, source AC or source DC power is converted by the installed power supply(ies) into the +5 VDC and –48 VDC required for router operation. These voltages are delivered to the backplane through the blind mating Elcon connector at the rear of the power supply enclosure. The backplane then distributes these operating voltages to all of the installed components in the system (see Figure 1-23).

The +5 VDC is fed to the MBus module on each installed card, and the –48 VDC is fed to a DC-DC converter on each card.

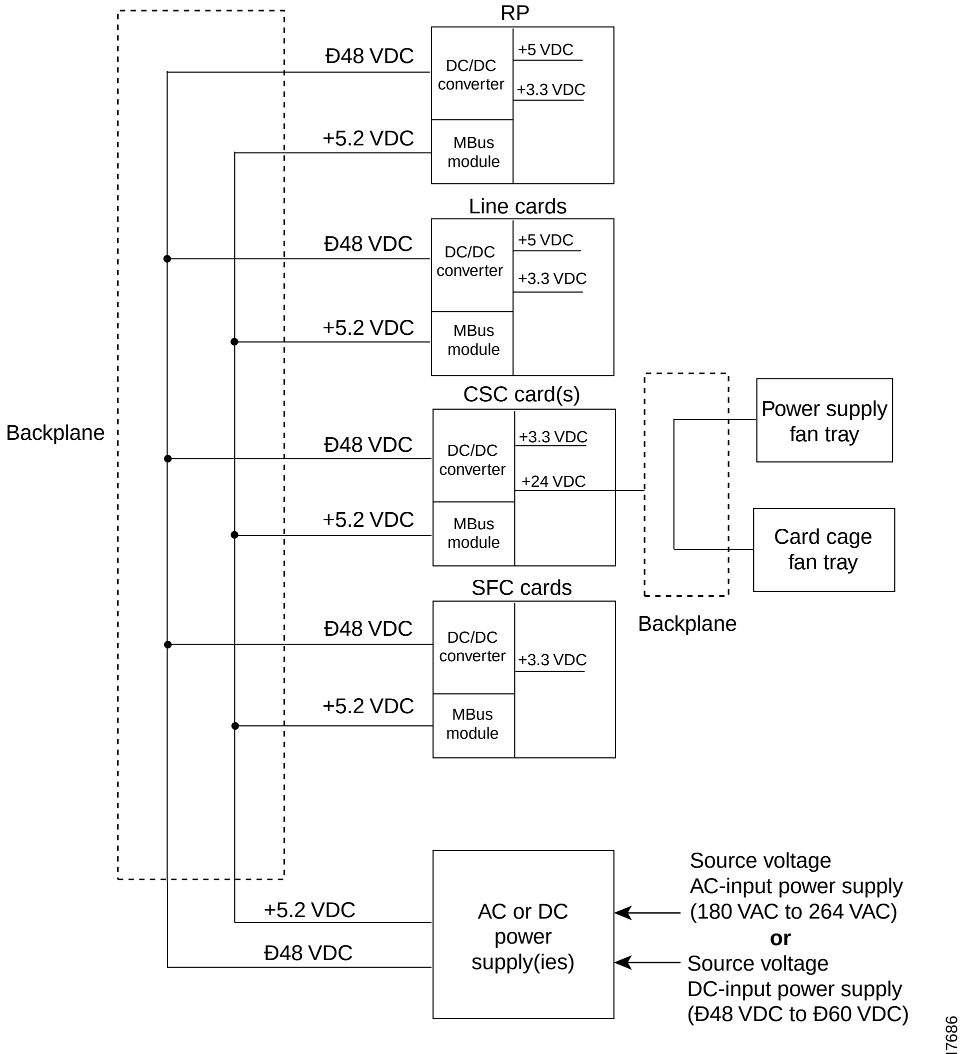
The DC-DC converter on each card operates under control of the card’s MBus module. When directed by the GRP or system software during normal system startup, the DC-DC converter on each card is activated to convert the –48 VDC from the backplane into the voltages required to power the card’s electronic circuitry.

The card cage fan tray and the power supply fan tray derive their operating power from a DC-DC converter on the CSC. This converter takes the –48 VDC from the backplane and converts it into the +24 VDC operating voltage required by the fan trays.

If an overtemperature condition is sensed anywhere within the router, or if any one of the fans fails in either the card cage fan tray or the power supply fan tray, the DC-DC converter on the CSC increases the voltage being delivered to the fan trays. This causes the fans to run at maximum speed to increase the volume of cooling air flowing through the router. Once the overtemperature condition is resolved, the fans revert to their normal operating speed.

Because the fans must operate continuously to prevent thermal damage to router components, they cannot be turned off by software.

Figure 1-23 Power Distribution System in the Cisco 12008



Minimum power supply configuration: One AC-input power supply **or** one DC-input power supply
Maximum power supply configuration: Two AC-input power supplies **or** two DC-input power supplies

Cisco 12008 Environmental Monitoring Facility

An environmental monitoring facility, called the maintenance bus (MBus), supports a variety of functions essential to router operations. These functions include the following:

- System discovery (enabling the router to identify installed components)
- Booting software images
- Supporting console traffic, logging functions, and diagnostic functions
- Monitoring the operational health of the router and reporting error conditions

The MBus facility in the router is interconnected by means of the backplane to the following components:

- GRP
- Line cards
- CSCs
- SFCs
- Power supplies

Each of the components listed here contains an onboard MBus module that incorporates two separate transceivers (A and B). Each transceiver has a separate etch (communication path) through the backplane. Consequently, all the MBus modules in the system are reliably interconnected to each other by means of redundant busses. This redundancy enhances the reliablity of the entire environmental monitoring system.

The MBus module on each component is powered by +5.2 VDC that it receives through the backplane from the power supply. A single MBus firmware image executes on all the MBus modules present in the system.

The master MBus module on the GRP monitors all the alarm conditions detected by the MBus modules in the other components of the system. The master MBus module then determines an appropriate response to the alarm condition.

The MBus modules on installed components perform the following functions:

- Power-up/down control—When power is applied to the router, the MBus module on the GRP and the CSC immediately receive +5.2 VDC through the backplane from the power supply, causing each card to supply power to its circuitry.

The MBus modules on other installed components then power up on command from the master MBus agent on the GRP.

- Device discovery—The GRP determines the system configuration by means of the MBus facility.

  A message is sent from the master GRP MBus agent, requesting that all installed components identify themselves. Each return response includes slot number, card type, and component type.

- Downloading software—A line card ROM monitor is loaded into Flash ROM on the card during the manufacturing process. This image, which can be field upgraded, if necessary, boots software to the line card by means of the MBus facility.

  Because the MBus is slow relative to the switch fabric, only enough code is initially downloaded to the line card to enable it to access the router's switch fabric.

  This initial code includes a line card fabric downloader that functions as a secondary bootstrap program to quickly complete the downloading of the Cisco IOS image to the line card by means of the router's high-speed switch fabric.

- Diagnostics—The MBus facility enables field diagnostics to be run on the GRP and the line cards, whether the router is in service (running diagnostics on an individual card without taking the router offline) or out of service (taking the entire router down to run diagnostics).

- Environmental monitoring and alarm functions—The environmental monitoring functions of the MBus system include the following:

  — Voltage and temperature monitoring for the router's installed components

  — Fan failure sensing for the card cage fan tray and the power supply fan tray

System Specifications

Table 1-8 lists the physical specifications of the Cisco 12008.

Table 1-9 outlines the electrical specifications of the AC-input power supply; Table 1-10 outlines similar specifications for the DC-input power supply.

Table 1-11 lists the environmental specifications of the Cisco 12008.

Table 1-8 Physical Specifications of the Cisco 12008

Description	Value
Chassis height	24.8 inches (63.6 cm)
Chassis width	17.4 inches (44.6 cm) 19.1 inches (48.5 cm), including mounting flanges
Chassis depth	21.2 inches (54.4 cm), including cable-management system
Weight, maximum configuration	180 lb (81.7 kg) with two DC-input power supplies 187 lb (84.9 kg) with two AC-input power supplies
Weight, minimum configuration	127 lb (57.7 kg)
Weight, shipping pallet	44 lb (20 kg)
Weight, total system, on pallet	231 lb (104.9 kg)
Weight, base chassis with backplane	50 lb (22.7 kg)
Weight, card cage fan tray	12 lb (5.4 kg)
Weight, power supply fan tray	2 lb (0.9 kg)
Weight, AC-input power supply	17 lb (7.7 kg)
Weight, DC-input power supply	14 lb (6.4 kg)
Weight, line card	8 lb (3.6 kg)
Weight, GRP	8 lb (3.6 kg)
Weight, CSC	7 lb (3.2 kg)
Weight, SFC	2 lb (0.9 kg)

Table 1-9 Electrical Specifications of the AC-Input Power Supply

Power Supply Type	Electrical Characteristic	Value
AC	Input power	Maximum: 2000W 200 VAC to 240 VAC @ 10A
AC	Input voltage	Nominal: 200 VAC to 240 VAC, single phase Tolerance limits: 180 VAC to 264 VAC
AC	Input current	9.5A @ 200 VAC
AC	Line frequency	47 to 63 Hz
AC	Output power	Maximum: 1560W –48 VDC @ 33.7A +5 VDC @ 20.8A)

Table 1-10 Electrical Specifications of the DC-Input Power Supply

Power Supply Type	Electrical Characteristic	Value
DC	Input power	Maximum: 1580W –40.5 VDC to –75 VDC @ 39A to 21A
DC	Input voltage	Nominal: –48 VDC (United States) Tolerance limits: –40.5 VDC to –56 VDC Nominal: –60 VDC (International) Tolerance limits: –58 VDC to –75 VDC
DC	Input current	33.75A maximum @ –48 VDC 27A maximum @ –60 VDC Internal circuit breaker is rated at 40A
DC	Output power	Maximum: 1542W –48 VDC @ 33.7A +5 VDC @ 20.8A

Table 1-11 Environmental Specifications of the Cisco 12008

Description	Value
Temperature	Operating: 32° to 104° F (0° to 40° C) Nonoperating: –4° to 149° F (–20° C to 65° C)
Humidity	Noncondensing, operating: 10 to 90% Noncondensing, nonoperating: 5 to 95%
Altitude	Operating: 0 to 10,000 ft (0 to 3048 m) Nonoperating: 0 to 30,000 ft (0 to 9144 m)
Heat dissipation	6,000 Btu/hr maximum
Acoustic Noise	69 dbA maximum
Shock	Operating: 5 to 500 Hz, 0.5 g[1] (0.1 oct/min[2]) Nonoperating: 5 to 100 Hz, 1 g (0.1 oct/min); 100 to 500 Hz, 1.5g (0.2 oct/min); 500 to 1000 Hz, 1.5 g (0.2 oct/min)

1. g = gravity.
2. oct/min = octave per minute.

Agency Approvals

In addition to meeting GR-63-CORE and GR-1089-CORE specifications, the Cisco 12008 meets the requirements of the agencies listed in Table 1-12.

Table 1-12 Agency Approvals

Category	Agency Approval
Safety	UL 1950
	CSA 22.2 No. 950
	EN60950
	AUSTEL TS001
	AS/NZS 3260
EMI	FCC Class A
	CSA Class A
	EN55022 Class A
	VCCI Class 2
	AS/NRZ 3548 Class A
Immunity	EN61000-4-2/IEC-1000-4-2
	EN61000-4-3/IEC-1000-4-3
	EN61000-4-4/IEC-1000-4-4
	EN61000-4-5/IEC-1000-4-5
	EN61000-4-6/IEC-1000-4-6
	EN61000-4-11/IEC-1000-4-11

CHAPTER 2

Preparing for Installation

This chapter provides specific information about preparing your site for installation of the Cisco 12008 router. Included are safety guidelines, specific preparatory information, and tools and parts required to ensure successful installation of your router.

The shipping package for Cisco 12000 series routers is engineered to reduce the potential of product damage associated with routine material handling experienced during shipment. To minimize potential damage to the product, transport these products in their Cisco-specified packagings. Failure to do so may result in damage to the router or degradation of its performance. Also, do not remove the GSR or Internet Router from its shipping container until you are ready to install it. The router should always be transported or stored in an upright position. Keep the router in the shipping container until you have determined where you will install it.

To unpack the router, use the document entitled *Cisco 12008 Gigabit Switch Router System Packing and Unpacking Instructions* that was shipped with your router. Inspect all items for shipping damage; if any damage is evident, immediately contact a Cisco customer service representative.

The following sections are included in this chapter:

- Safety Recommendations
- Site Requirements Guidelines
- System Ground Connection Guidelines
- Site Wiring Guidelines
- Installation Tools Required
- Unpacking the Cisco 12008

- Checking the Contents of the Shipping Container
- Using a Site Log

Before attempting to install your router, consider the power and cabling requirements that must be satisfied, the equipment that you will need to install the router, and the environmental conditions that your site must meet.

Safety Recommendations

The following guidelines are provided to help ensure your safety and to protect the equipment. This list may not identify all potentially hazardous situations in your working environment, so *be alert* and *exercise good judgment* at all times.

- Never attempt to lift an object that might be too heavy for one person to handle.
- Always disconnect the power source and unplug all the power cables before working on the router.
- Keep the work area free of obstructions before, during, and after router installation.
- Keep tools and router components away from walk areas.
- Do not wear loose clothing, jewelry (such as rings, bracelets, or chains), or other items that could get caught in the router during handling and use.
- Use the router in accordance with its marked electrical ratings and product usage instructions.
- Do not work alone if potentially hazardous conditions exist anywhere in your workplace.
- Install the router in compliance with the following local and national electrical codes:
  - — United States—National Fire Protection Association (NFPA) 70; United States National Electrical Code.
  - — Canada—Canadian Electrical Code, part I, CSA C22.1.
  - — Other countries—International Electrotechnical Commission (IEC) 364, part 1 through part 7.

- Review the safety warnings contained in the document entitled *Regulatory Compliance and Safety Information for the Cisco 12000 Series Gigabit Switch Routers* (Document Number 78-4347-02). This document accompanied the shipment of your Cisco 12008 router; familiarize yourself with its contents before attempting to install, configure, or maintain the router.
- Cisco 12008 routers configured with AC-input power supplies are shipped with a 3-wire electrical grounding-type plug that fits only into a grounding-type power outlet. This is a safety feature that you should not circumvent. Equipment grounding should comply with local and national electrical codes.
- Cisco 12008 routers configured with DC-input power supplies require a 40-ampere DC circuit breaker for the input DC power source. This circuit breaker should protect against short-circuit and overcurrent faults in accordance with United States National Electrical Code NFPA 70 (United States), Canadian Electrical Code, part I, CSA C22.1 (Canada), and IEC 364 (other countries).
- Only a DC power source that complies with the safety extra-low voltage (SELV) requirements in UL950, CSA 950, EN 60950, and IEC950 can be connected to a Cisco 12008 DC-input power supply.
- A Cisco 12008 configured with DC-input power supplies that is to be used in a restricted access area must be installed in accordance with Articles 110-16, 110-17, and 110-18 of the National Electric Code, ANSI/NFPA 70.
- A Cisco 12008 configured with DC-input power supplies must have a readily accessible disconnect device incorporated in the fixed wiring for the site.

Lifting Guidelines

A fully configured Cisco 12008 router weighs approximately 187 lb (84.8 kg); it is not intended to be moved frequently.

Before installing the router, ensure that your site is prepared properly so that you can avoid having to move the router later to accommodate the availability/proximity of power sources and network interface connections.

Whenever you lift or move the router (or any other heavy object), observe the following guidelines:

- Enlist the assistance of a second person when lifting the router; do not attempt to lift the router by yourself.
- Secure your footing when lifting the router; balance the lifted weight between your feet.
- Lift the assembly slowly; avoid making sudden movements; avoid twisting your body as you lift.
- Keep your back straight and lift with your legs. If you must bend down to lift the router, bend at your knees, rather than your waist, to reduce the strain on your lower back.
- Always disconnect all external cables before lifting or moving the router.

Caution Never attempt to lift, tilt, or move the router using the carrying handles on the AC-input and DC-input power supplies. These handles are meant to help you carry the power supplies; they are not designed to support the weight of the router.

Safety with Electricity

The line cards, a redundant CSC, the SFCs, the fan trays, and a redundant power supply can be removed and replaced while the system is running. In removing such components, there is no danger that an electrical hazard or system damage will result.

Observe the following basic guidelines when working with any electrical equipment:

- Before beginning any procedure that requires access to the interior of the router, locate the emergency power-off switch for the room in which you will be working.
- If an electrical accident occurs and someone is hurt, proceed as follows:
  - — Use caution; do not become a victim yourself. Disconnect power from the system.
  - — If possible, send another person to get medical aid; otherwise, assess the condition of the victim and call for help.
  - — Determine if the person needs rescue breathing or external cardiac compressions; take appropriate action.
- Disconnect all power and external cables before installing or removing a router.
- Never assume that power has been disconnected from a circuit; always check beforehand.

- Do not perform any action that creates a potential hazard to personnel or makes the equipment unsafe.
- Never install equipment that appears to be damaged.
- Carefully examine your work area for possible hazards, such as moist floors, ungrounded power extension cables, and missing safety grounds.

In addition, observe the following guidelines when working with any equipment that is disconnected from a power source, but still connected to telephone or network wiring:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Preventing Electrostatic Discharge Damage

Many router components are sensitive to damage from static electricity. Some components can be degraded by exposure to as little as 30 volts. You can generate static voltages as high as 35,000 volts just by handling plastic or foam packing material, or by sliding an electronic assembly across plastic or carpeting. Failure to exercise proper electrostatic discharge damage (ESD) precautions can result in intermittent or complete failures of components.

To minimize the potential for ESD damage to electronic components, observe the following guidelines:

- Always wear an ESD wrist strap or ankle strap and ensure that it makes good contact with your skin.
- Insert the equipment end of your ESD strap (the banana plug) into the ESD socket in the upper left edge of the upper card cage before you insert or remove a line card, a CSC, or the RP.

  Avoid contact between the card and your clothing. The wrist strap protects the card from ESD voltages on the body only; EDS voltages on clothing can still cause electronic component damage.

- Always place a card component side up on an antistatic surface, in an antistatic card rack, or in a static-shielding bag. If you are returning a card to the factory, immediately place it in a static-shielding bag.
- Use the ejector levers to properly seat the card connectors in the backplane when you are installing line cards or the RP; tighten both captive installation screws on the card.

  These screws prevent accidental removal, provide proper grounding for the system, and help to ensure that the card connector is seated in the backplane.
- Use the ejector levers to unseat the card connector from the backplane when removing a line card or the RP.

  Slowly pull the metal card carrier out of the slot with one hand, placing your other hand along the bottom of the card carrier to support the card's weight and guide it straight out of the slot.
- Handle line cards or the RP only by the edges of the metal card carrier; avoid touching the board or the connector pins.

Caution For safety, periodically check the resistance value of the antistatic strap. The resistance measurement should be between 1 and 10 megohms.

Laser Safety

Single-mode style line cards for the Cisco 12008 are equipped with lasers that emit invisible radiation. Do not stare into open line card ports. Observe the following warning to prevent eye injury.

Warning Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.

Site Requirements Guidelines

Before installing the Cisco 12008 router, review the guidelines presented in the following sections.

Rack-Mounting Guidelines

Before installing the Cisco 12008 in a telco-style or 19-inch equipment rack, consider the following rack-mounting guidelines:

- Install the router in an enclosed rack only if the rack has adequate ventilation or an exhaust fan; install the router in an open rack whenever possible.
- An enclosed rack with a ventilation system that is too powerful can prevent proper cooling of the router by creating negative air pressure around the router and redirecting air away from the intake of the air filter assembly. If necessary, operate the router with the rack door open.
- The proper use of baffles inside an enclosed rack can help ensure adequate router cooling.
- Equipment placed in the rack beneath the router can generate heat that is drawn into the router's air filter assembly, adding to the router's heat load.

  If the enclosed rack in which you install the router does not have a ventilation fan, you should install one.

The rack-mounting hardware included with the Cisco 12008 is suitable for most 19-inch equipment racks or telco-style racks. We strongly recommend a rack-mount installation for your router, due to size and weight considerations.

The specific rack-mounting guidelines for your router follow:

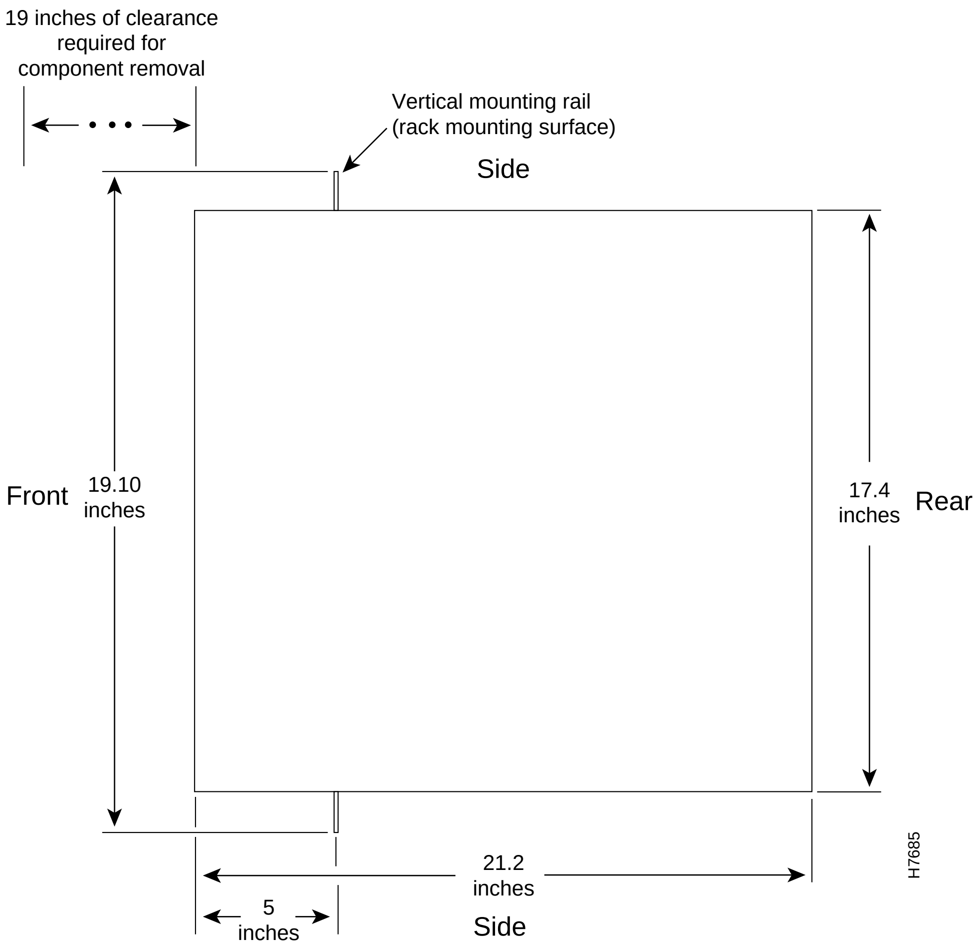
- Keep the center of gravity of the equipment rack as low as possible.

  Mount the router in the rack as low as possible without sacrificing router utility, accessibility, or serviceability.

- If you mount the router in a telco-style rack, ensure that the rack is bolted to the floor. Ensure that the weight of the router does not make the rack unstable. Some telco-style racks are also secured to ceiling brackets, if necessary, due to the weight of equipment in the rack. Make sure that the rack you are using to install the router is secured to the building structure.
- In mounting the router between two posts or rails, you must ensure that the clearance between the sides of the posts or rails is at least 17.5 inches (44.9 cm).
- Maintain a clearance of at least 6 inches (15.2 cm) at the front and back of the router to ensure adequate air intake and exhaust.
- Avoid installing the router in an overly congested rack. Air flowing to or from other equipment in the rack might interfere with the normal flow of cooling air through the router, increasing the potential for overtemperature conditions within the router.
- Allow at least 19 inches (48.7 cm) of clearance at the front of the rack for router maintenance.
- Install and use the cable-management system included with your router. The cable-management system helps to keep interface cables organized, out of the way, and free from kinks or bends that degrade cable performance.
- Consider the equipment and cabling that may already be installed in the rack. Ensure that interface cables from other equipment do not impair access to the router's upper card cage or lower card cage or require you to disconnect cables unnecessarily to perform equipment maintenance or upgrades.
- When mounting the router in a 4-post or telco-style rack, use the mounting hardware, as instructed, to properly secure the router in the rack.

Figure 2-1 shows the outer dimensions of the Cisco 12008 enclosure.

Figure 2-1 Outer Dimensions of Cisco 12008 Enclosure (Top View)



Air Flow Guidelines

The Cisco 12008 air circulation system includes two fan trays:

- Card cage fan tray—This router component is located behind the air filter assembly (see Figure 2-2).

  The card cage fan tray draws ambient air through a removable and serviceable air filter assembly in the front of the router, passes it over the switch fabric cards in the lower card cage, directs it upward through the circuit boards in the upper card cage, and exhausts it through vents at the top rear of the router enclosure (see Figure 2-4).

- Power supply fan tray—This router component is located at the bottom of the power supply bay (see Figure 2-3).

  The power supply fan tray draws ambient air through its faceplate, directs the air upward through the power supply bays, and exhausts it through vents at the top rear of the router enclosure (see Figure 2-4).

To ensure adequate air flow through the router's internal components, it is recommend that you maintain a clearance of at least 6 inches (15.4 cm) in the front and back of the router enclosure at all times.

If airflow through the router is blocked or restricted, or if the ambient air being drawn into the router is too warm, an overtemperature condition within the router can occur. Under extreme conditions, the router's environmental monitoring (MBus) system shuts down system power to protect internal electronic components from thermal damage.

The site should be as dust-free as possible. Dust tends to clog the air filter, reducing the flow of cooling air through the system and increasing the risk of an overtemperature condition.

Figure 2-2 Card Cage Fan Tray

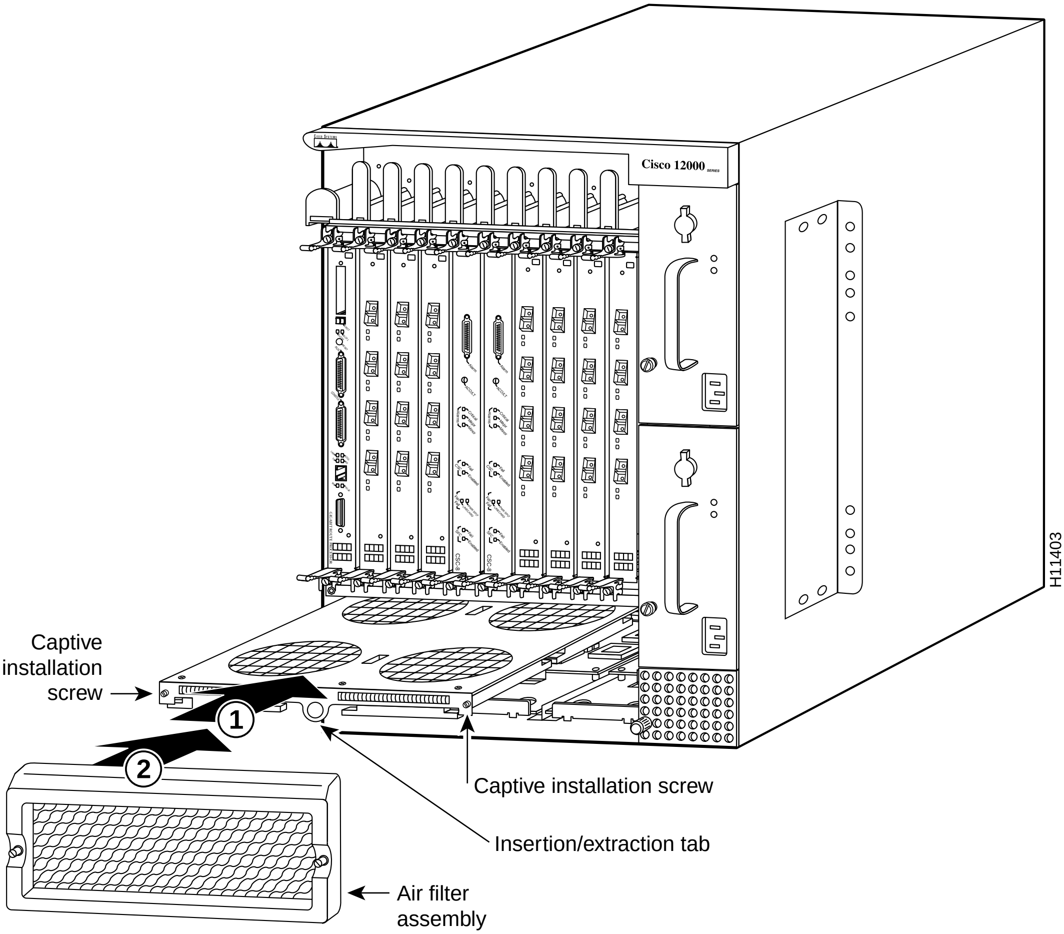


Figure 2-3 Power Supply Fan Tray

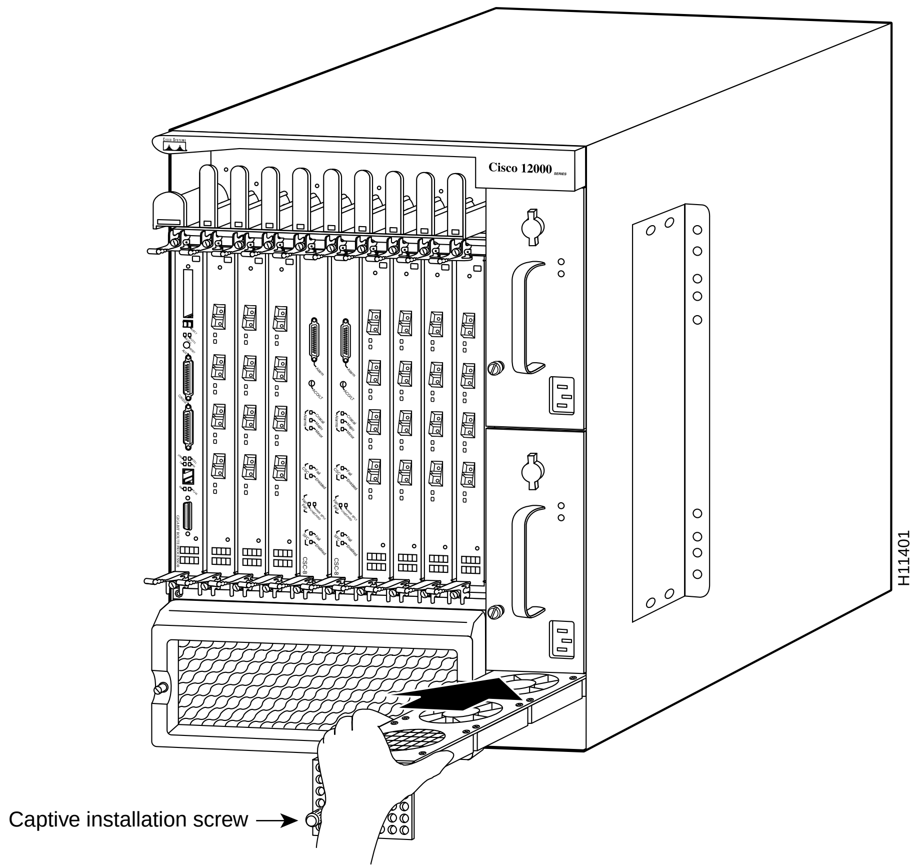
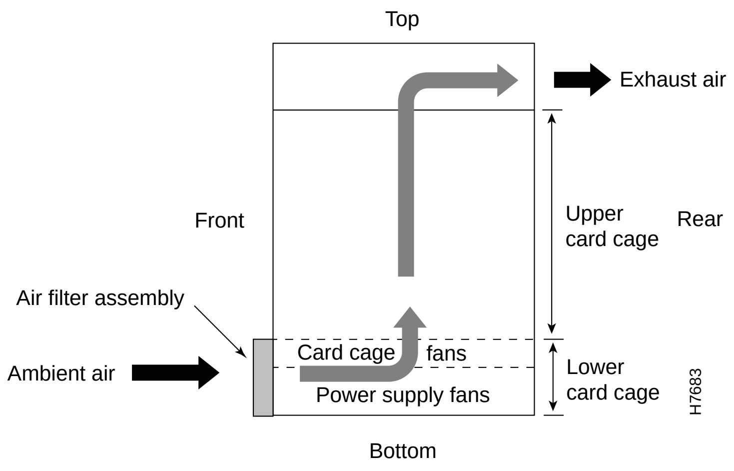


Figure 2-4 Internal Air Flow of the Cisco—Side View



Temperature and Humidity Guidelines

For the operating and nonoperating environmental specifications for the Cisco 12008, refer to Table 1-11 in Chapter 1. The router operates within the ranges specified in this table; however, a temperature that approaches a minimum or maximum level indicates a potential problem. You can maintain normal system operations by anticipating and correcting environmental anomalies before they approach a critical state.

The environmental monitors built into the Cisco 12008 protect system components from potential damage from overvoltage and overtemperature conditions. To ensure normal operations and avoid unnecessary maintenance, plan and prepare your site properly before installing the router.

Power Guidelines

The Cisco 12008 router can be configured with *either* AC-input *or* DC-input power supplies.

Note Combining an AC-input power supply with a DC-input power supply in the same router is *not* allowed.

A minimally configured router has one AC-input power supply or one DC-input power supply. Site requirements for the power supplies differ, depending on the type of source voltage required for the installed power supply(ies).

Observe the following general precautions and recommendations in planning the source power requirements for your router:

- Check the power at your site before router installation (and periodically after installation) to ensure that clean power is being received. Install a line conditioner, if necessary, to ensure proper voltages and power levels in the source voltage for the system.
- Install proper grounding for the site to avoid damage from lightning and power surges.

AC-Powered Systems

In a router to be equipped with AC-input power supplies, observe the following guidelines:

- The power supply must operate with a source voltage ranging from 185 to 264 VAC; the AC-input power supply requires a 20A service minimum for North America and 10A or 16A for the international area.
- Several styles of AC-input power supply power cords are available; make sure that you have the correct style for your site (see Figure 2-5 and Table 2-1).

  All AC-input power supply power cords are 14 feet (4.3 m) in length.
- Check the power at your site before installation and periodically thereafter to ensure that you are receiving clean power that is free of noise. Install a line conditioner, if necessary, to ensure proper electrical characteristics of source power.

- Provide a dedicated power source for each AC-input power supply installed in the router.
- Install an uninterruptible power source for your site, if possible.
- Install proper site grounding facilities to guard against damage from lightning or power surges.

For a listing of the electrical specifications for the AC-input power supply, see Table 1-9 in Chapter 1.

Figure 2-5 lists the source AC power cords available for the Cisco 12008.

Figure 2-5 Types of Plugs for Source AC Power

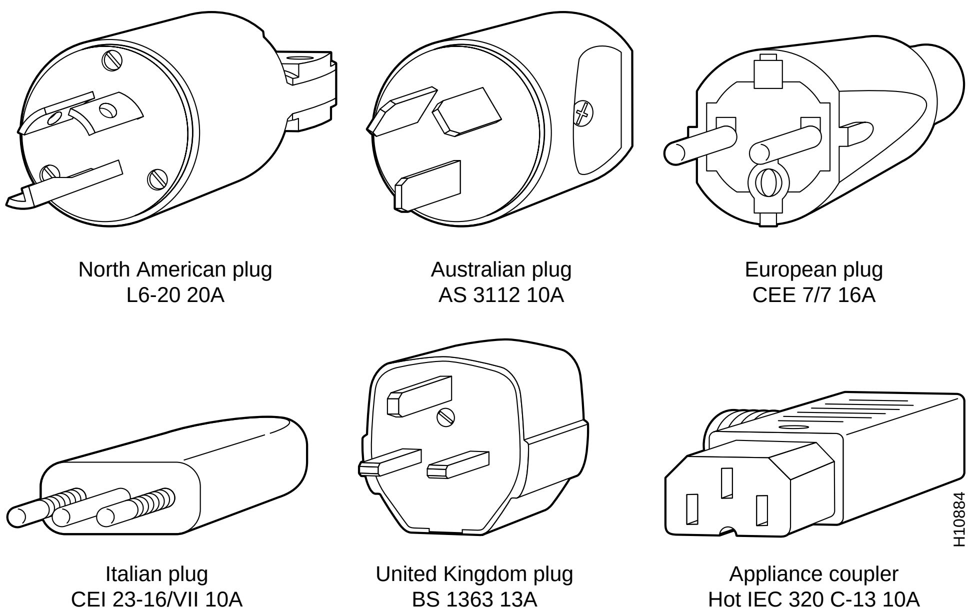


Table 2-1 lists the international options available for the source AC power cords.

Table 2-1 AC Power Cord International Options

Label	Description	Product Number
United States	208 VAC, 60 Hz AC power cord	CAB-GSR12-US=
Australian	240 VAC, 50 Hz AC power cord	CAB-GSR12-AU=
European	230 VAC, 50 Hz AC power cord	CAB-GSR12-EU=
Italian	220 VAC, 50 Hz AC power cord	CAB-GSR12-IT=
United Kingdom	240 VAC, 50 Hz AC power cord	CAB-GSR12-UK=

Note All source AC power cords are 14 feet (4.27 m) in length.

DC-Powered Systems

In a router to be equipped with DC-input power supplies, observe the following guidelines:

- Each DC-input power supply requires a dedicated 40A service.
- For DC power cables, it is recommended that you use 4 AWG, high-strand-count wire cable with dual hole lugs that fit over M6 (metric) terminals centered 0.625 inch (15.86 mm) apart.

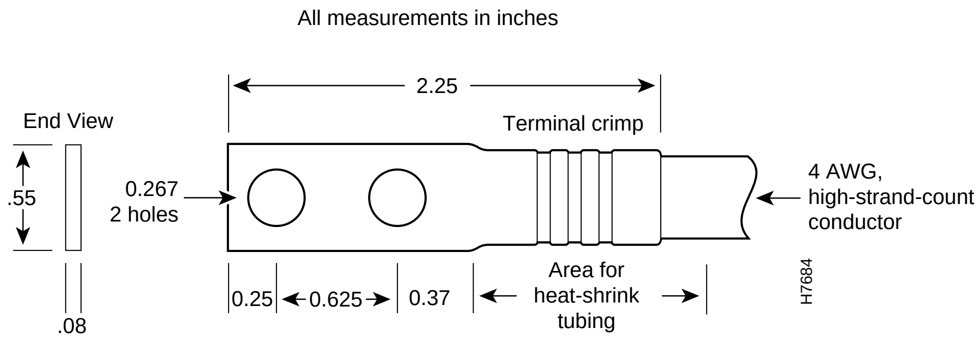
For a listing of the electrical specifications for the DC-input power supply, see Table 1-10 in Chapter 1.

Figure 2-6 shows the specifications of the lug used for source DC power cable connections.

Note To prevent the crimp area on the lug (see Figure 2-6) from coming in contact with the metal faceplate of the DC-input power supply, add a length of heat-shrink tubing to this area of the lug to provide extra insulation.

Each set of power terminals on the DC-input power supply faceplate consists of two 6-mm, metric-threaded, nickel-plated brass studs centered 0.625 inch apart. The earth ground studs extend 0.52 inch (13.2 mm) above the power supply faceplate; the set of positive (+) and negative (–) studs extend 0.9 inch (22.9 mm) above the faceplate. The nickel plating on the studs enhance their conductivity and ensure corrosion resistance.

Figure 2-6 Dimensions of the Lugs Used with the Source DC Power Cables



For convenience, the lockwashers and nuts for connecting the source DC cables to the nickel-plated brass studs are loosely mounted on the studs ready for use.

In making source DC connections to the power supply, use the power cables and lugs having the specifications outlined in Table 2-2. An equivalent 2-hole lug is acceptable as a substitute for the Panduit DC power cable lug.

Table 2-2 Specifications of the Source DC Power Cable and Lug

Characteristic	Specification
DC power cable size	#4 AWG, high strand count copper wire
DC power cable lug	Panduit copper, standard barrel, 2-hole lug—Type LDC (Panduit part number: LCD4-14A-L). An equivalent 2-hole lug is acceptable as a substitute for the Panduit part.

System Ground Connection Guidelines

Before connecting power to or turning on the Cisco 12008, be sure to provide an adequate ground connection for your system.

Two system (earth) grounding holes are provided on each side panel of the router enclosure, approximately 3 inches from the bottom rear of the panel (Figure 2-7).

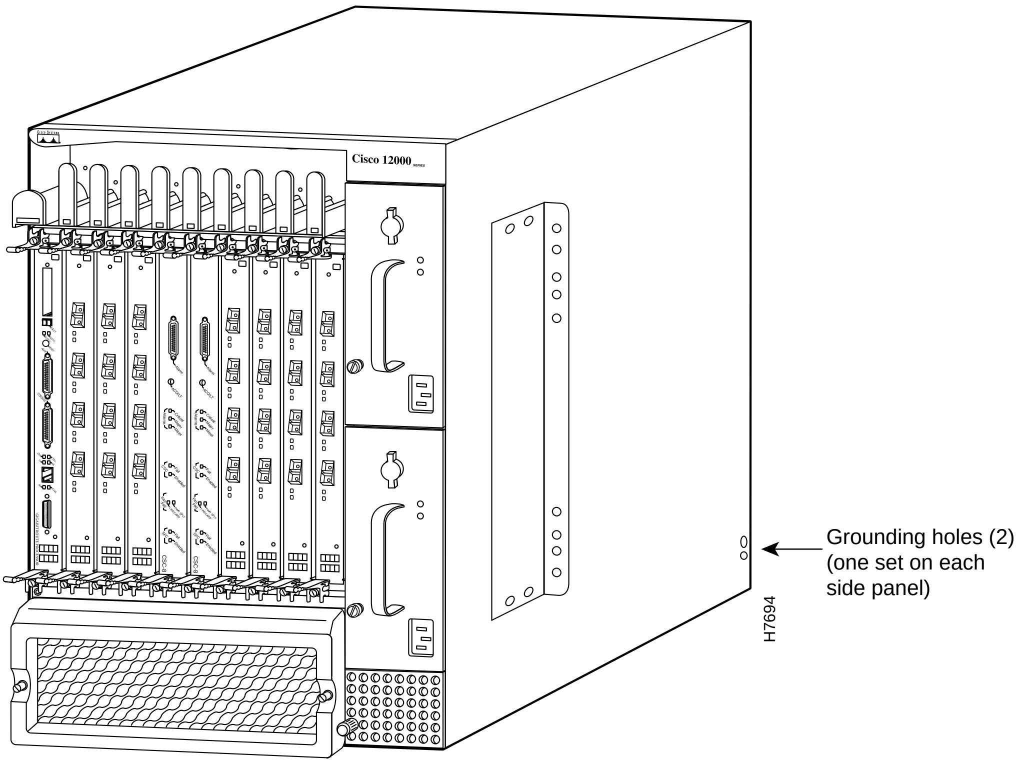
To make an adequate grounding connection, you will need the following parts:

- Two grounding lugs—The grounding lugs must have two M6 screw holes that have 0.625 to 0.75 inch (15.86 to 19.05 mm) spacing between them.

  These lugs are similar to those used for the DC-input power supply (see Figure 2-6). The grounding lugs are not available from Cisco Systems; any electrical-connector vendor, such as Panduit, can readily provide this lug.
- Four M6 (metric) hex-head screws with locking washers—These screws are not available from Cisco Systems; they are readily available from any commercial hardware vendor.
- Two grounding wires (4 AWG recommended)—The length of the grounding wires depends on the location of your router within the site and its proximity to proper grounding facilities. The grounding wire is not available from Cisco Systems; it is readily available from any commercial cable vendor.

The procedure for connecting system ground to your router is presented in Chapter 3 in the section entitled "Connecting System Ground."

Figure 2-7 Grounding Holes on the Cisco 12008



Site Wiring Guidelines

This section presents guidelines for setting up site wiring and cabling for your router. When planning the location for your router, you should take into account the following:

- Electromagnetic interference (EMI)
- Distance limitations for fiber-optic transmission
- Connector compatibility

EMI Considerations

When wires are run for any significant distance in an electromagnetic field, interference can occur between the electromagnetic field and the signals on the wires. Be aware of the following points:

- Bad site wiring practices can result in the emanation of radio frequency interference (RFI) within the site.
- Strong EMI, especially that caused by lightning or radio transmitters, can destroy the signal drivers and receivers in the router. EMI can even create an electrical hazard by conducting power surges through lines into equipment.

Note To predict and remedy strong EMI, you might need to consult an RFI expert.

If you use twisted-pair cables in your plant wiring with an adequate distribution of grounding conductors, the plant wiring is unlikely to emit RFI. If you exceed the recommended cabling distances, use a high-quality twisted-pair cable with one ground conductor for each data signal.

If wires exceed recommended distances, or if wires pass between buildings, give special consideration to the effect of a lightning strike in your vicinity. The electromagnetic pulse (EMP) caused by lightning or other high-energy phenomena can easily couple enough energy into unshielded conductors to destroy electronic devices. If you have had problems of this kind in the past, you may want to ask experts for assistance in electrical surge suppression and shielding.

Most data centers cannot resolve the infrequent, but potentially catastrophic, problems described above without pulse meters and other special equipment. Such problems are difficult to identify and resolve, so take precautions by providing a properly grounded and shielded environment, paying special attention to issues regarding electrical surge suppression.

Synchronous Optical Network Connection Guidelines

The Synchronous Optical Network (SONET) specification for fiber-optic transmission defines two types of fiber:

- Single mode
- Multimode

Data transmission in either mode occurs by means of bundles of light rays that enter the fiber at a particular angle.

Single-mode fiber allows only one mode of light to propagate through the fiber; multimode fiber allows multiple modes of light to propagate through the fiber.

Multiple modes of light propagating through the fiber travel different distances, depending on entry angles, causing the light to arrive at destinations at different times. This phenomenon is called modal dispersion.

Single-mode fiber provides higher-bandwidth transmission and supports greater cable distances than multimode fiber. Table 2-3 lists the maximum distances for single-mode and multimode fiber-optic transmissions, as defined by SONET.

If the distance between two connected stations is greater than the maximum distance specified in Table 2-3, significant signal loss can result, making fiber-optic transmission unreliable.

Table 2-3 SONET Maximum Fiber-Optic Transmission Distances

Transceiver Type	Maximum Distance between Stations[1]
Single-mode	Up to 9 miles (14.5 km)
Multimode	Up to 1.5 miles (2.4 km)

1. Typical results; you should use the power budget calculations to determine the actual distances.

Power Budget

To design an efficient optical data link, you must evaluate the power budget.

The power budget represents the amount of light that must be available to overcome attenuation in the optical link and to exceed the minimum power required by the receiver to operate within specifications. Proper operation of an optical data link depends on modulated light reaching the receiver with enough power to be correctly demodulated.

The following variables reduce the power of the signal (light) transmitted to the receiver in multimode transmission:

- Attenuation losses—Losses incurred by passive media components, such as cables, cable splices, and connectors. Such losses are common in both multimode and single-mode data transmission.
- Chromatic dispersion losses—Losses incurred by the spreading of the signal in time due to the different speeds of light wavelengths.
- Modal dispersion losses—Losses incurred by the spreading of the signal in time due to the different propagation modes in the fiber.

Attenuation is significantly lower for optical fiber than for other media.

For multimode transmission, chromatic and modal dispersion reduce the available power of the system by what is referred to as the combined dispersion penalty (in decibels [dB]). The power lost over the data link is the sum of the attenuation losses, dispersion losses, and modal losses.

Table 2-4 lists the attenuation and dispersion limits for typical fiber-optic cable.

Table 2-4 Typical Fiber-Optic Link Attenuation and Dispersion Limits

Factor	Single-Mode	Multimode
Attenuation	0.5 dB	1.0 dB/km
Dispersion limit	No limit	500 MHz/km[1]

1. The product of bandwidth and distance must be less than 500 MHz/km.

Approximating the Line Card Power Margin

The LED used for a multimode transmission light source creates multiple propagation paths of light, with each path having a different path length and time requirement to cross the optical fiber. This causes signal dispersion (smear).

Higher order loss (HOL) results from light from the LED entering the fiber and being radiated into the fiber cladding. A worst-case estimate of power margin (PM) for multimode transmissions is based on assumptions of minimum transmitter power (PT), maximum link loss (LL), and minimum receiver sensitivity (PR). The worst-case analysis provides a margin of error, because not all parts of an actual system will operate at worst-case levels.

The power budget (PB) is defined as the maximum possible amount of power transmitted. The following equation shows the calculation of the power budget:

$$PB = PT - PR$$

$$PB = -18.5\ \text{dBm} - (-30\ \text{dBm})$$

$$PB = 11.5\ \text{dB}$$

The power margin is equal to the power budget minus the link loss:

$$PM = PB - LL$$

If the power margin is positive, as a rule, the fiber-optic link will work satisfactorily.

Table 2-5 lists the factors that contribute to link loss and the estimate of the link loss value attributable to the link loss factors.

Table 2-5 Estimating Link Loss

Link Loss Factor	Estimate of Link Loss Value
Higher order mode losses	0.5 dB
Clock recovery module	1 dB
Modal and chromatic dispersion	Depends on fiber and wavelength used
Connector	0.5 dB
Splice	0.5 dB
Fiber attenuation	1 dB/km

Subtracting the data link loss from the power budget should produce a result greater than zero. If a result is less than zero, you may have insufficient power for receiver operation.

For SONET line cards, the signal must meet the signal requirements listed in Table 2-6.

Table 2-6 Line Card SONET Signal Requirements

Characteristic	Single-Mode	Multimode
Minimum transmitter power (PT)	–18.5	–15
Minimum receiver sensitivity (PR)	–30	–28
Power Budget (PB)	–11.5	–13

Multimode Power Budget Example (with Sufficient Power for Transmission)

This section contains a sample calculation of a multimode power budget, based on the following variables:

- Length of multimode link = 3 km
- Four connectors
- Three splices
- Higher order loss (HOL)
- Clock recovery module (CRM)

Estimate the power budget, as follows:

PB = 13 dB – 3 km (1.0 dB/km) – 4 (0.5 dB) – 3 (0.5 dB) – 0.5 dB (HOL) – 1 dB (CRM)

PB = 13 dB – 3 dB – 2 dB – 1.5 dB – 0.5 dB – 1 dB

PB = 5 dB

The resulting power budget (PB) value of 5 dB indicates that this link would have sufficient power for fiber-optic transmission.

Multimode Power Budget Example of Dispersion Limit

Below is a multimode power budget example based on the same parameters as in the previous example, but with a multimode link distance of 4 km:

PB = 13 dB – 4 km (1.0 dB/km) – 4 (0.5 dB) – 3 (0.5 dB) – 0.5 dB (HOL) – 1 dB (CRM)

PB = 13 dB – 4 dB – 2 dB – 1.5 dB – 0.5 dB – 1 dB

PB = 4 dB

The resulting power budget (PB) value of 4 dB indicates that this link would have sufficient power for transmission; however, due to the dispersion limit on the link (4 km x 155.52 MHz > 500 MHz/km), this link would not work with multimode fiber. In this case, single-mode fiber would be the better choice.

Single-Mode Transmission

The single-mode signal source for fiber-optic transmission is an injection laser diode.

Single-mode transmission is useful for longer distances because a single transmission path within the fiber is used and smear does not occur. In addition, chromatic dispersion is reduced because laser light is essentially monochromatic.

The maximum overload limit on the single-mode receiver is –14 dBm. The single-mode receiver can be overloaded when short lengths of fiber are used because the transmitter can transmit up to –8 dB. The receiver could be overloaded at –14 dB, but no damage will result.

To prevent overloading the receiver when you are interconnecting short fiber links, insert a 5 to 10 dB attenuator on the link between any single-mode SONET transmitter and the receiver.

SONET Single-Mode Power Budget Example

The following example of a single-mode power budget is for two buildings, 11 kilometers apart, that are connected through a patch panel in an intervening building. The entire link is made up of 12 connectors.

- Length of single-mode link = 11 km
- 10 connectors

Estimate the power budget as follows:

PB = 11.5 dB – 11 km (0.5 dB/km) – 10 (0.5 dB)

PB = 11.5 dB – 5.5 dB – 5 dB

PB = 1 dB

The resulting power budget (PB) value of 1 dB indicates that this link would have sufficient power for transmission and would not exceed the maximum receiver input power.

Using Statistics to Estimate the Power Budget

Statistical models are more accurate in determining the power budget than “worst-case” methods.

Determining the link loss with statistical methods requires accurate knowledge of variations in the data link components. However, statistical power budget analysis is beyond the scope of this document.

For further information on this topic, refer to the UNI Forum specifications, ITU-T standards, and your equipment specifications.

Installation Tools Required

The Cisco 12008 can be installed with a minimum number of tools:

- 1/4-inch flat-blade screwdriver
- 3/16-inch flat-blade screwdriver
- Number 2 Phillips head screwdriver
- ESD-preventive wrist strap
- Antistatic mat
- Tape measure
- Level
- 10-mm wrench (boxed-end, socket, or nut driver)—for connecting DC source power cables to the DC-input power supply terminals

- 9/16-inch wrench (open-end or socket)—for removing the lag bolts from the router shipping pallet
- Wire cutters
- Pliers

Unpacking the Cisco 12008

To unpack your Cisco 12008, use the instructions in the document entitled *Cisco 12008 Gigabit Switch Router System Packing and Unpacking Instructions*, which was shipped with the router. Appendix A of this document describes the shipping container for the Cisco 12008; it also provides instructions for unpacking the router prior to installation and how to repackage the router if you need to move it at some later time.

Note Do not discard the packaging materials used in shipping your router. You will need this material in the future if you move or ship your router.

If the packing materials are lost or damaged, replacement packing materials are available as an orderable item (product number PKG-GSR8=).

Checking the Contents of the Shipping Container

Check the contents of the shipping container to verify that the following items have been included in the shipment:

- One Cisco 12008 router as ordered, fully assembled
- One RP
- CSCs, SFCs, and line cards, as ordered
- One or two AC-input or DC-input power supplies, as ordered, already installed in the router
- An accessories box (packed with the router on the shipping pallet)

If you do not receive everything you ordered, contact a Cisco customer service representative for assistance.

Using a Site Log

It is good practice to use a site log to record all actions taken relevant to router operation and maintenance. Keep the site log near the router for ready access by the site manager or other personnel.

Site log entries might include the following:

- Installation progress—Make entries in the site log about any difficulties encountered and the remedial steps taken during the installation process.
- Upgrades and removal/replacement procedures—Make entries in the site log about system maintenance activity and hardware/software upgrades.

  Relevant items in the site log might include the following:

  — Installation, removal, or replacement of an FRU

  — Router configuration changes

  — Software upgrades

  — Hardware upgrades

  — Corrective or preventive maintenance procedures

  — Intermittent failures/problems

  — Related comments

Figure 2-8 is an example of a typical site log. You can use this one or design one of your own that meets the needs of your particular site.

Figure 2-8 Sample Site Log

Date	Description of Action Performed or Symptom Observed	Initials

H7706

CHAPTER 3

Installing a Cisco 12008

This chapter presents the procedures for installing and starting the Cisco 12008. It contains the following sections:

- Installation Considerations
- Installing the Mounting Brackets
- Removing Components from the Router
- Rack-Mounting the Cisco 12008
- Reinstalling Components in the Router
- Connecting the Line Card Cables
- Connecting Route Processor Cables
- Connecting an External Alarm Monitoring Facility
- Connecting System Ground
- Connecting Source Power to the Power Supplies
- Starting the Cisco 12008

Installation Considerations

The Cisco 12008 offers the following mounting options:

- A 2-post, telco-style rack
- A 4-post, full-height equipment rack
- Shelf-top mounting
- Freestanding system

The installation procedures presented in this chapter pertain only to the first two of these mounting options.

Before attempting to install your Cisco 12008, you should determine the mounting option that you intend to use. It is assumed that you have already moved the shipping pallet containing the router to the intended installation area.

Ensure that you have selected and prepared a compatible location for installing the router. Consider the following:

- Will the selected location interfere with the flow of ambient cooling air through the router?

  You must ensure at least 6 inches (15.2 cm) of clearance in the front and back of the router enclosure for the air intake and exhaust vents.

- Does the selected location provide a temperature-controlled, air-conditioned, and dust-free operating environment?
- Are the power cables and power supplies to be used with your router compatible with the source power available in the selected location?

  Check the labels on the faceplate of the router’s power supply(ies) and ensure that the source power available at the site is compatible.

- Is the proper source voltage (AC or DC) available at the site?
- Do you intend to install the router in a telco-style rack or a 4-post equipment rack?
- Have you allowed sufficient access and clearance around the router enclosure to meet maintenance requirements?

You must allow at least 24 inches (61 cm) of clearance in front of the router enclosure for installing or replacing line cards, fan trays, and power supplies, and for attaching network interface cables or equipment.

Caution You cannot use an AC-input power supply and a DC-input power supply in the same router. All power supplies installed in a router must be of the same type. Do not attempt to install an AC-input power supply in a router with a DC-input power supply, or vice versa.

Installing the Mounting Brackets

Mounting brackets are shipped with every Cisco 12008 as part of an accessory kit. These mounting brackets are designed for use with either a telco-style (2-post) or a 4-post equipment rack. For simplicity, the procedure in this section describes the use of the mounting brackets in conjunction with a telco-style rack.

Use of the mounting brackets is optional; you can install the Cisco 12008 in the rack without using these brackets. However, due to the size and weight of the router, it is recommended that these brackets not only be used, but also that two or more people install the router to minimize the risk of personal injury or damage to the equipment.

Note The mounting brackets temporarily bear the weight of the router while it is being positioned in the rack for permanent installation. These brackets can be left in place following router installation.

To prepare for router installation, you can install the mounting brackets directly opposite each other in the rack at any desired height. The height chosen should take into account the following factors:

- The network cabling and equipment installation requirements
- Whether or not other equipment is (or will be) installed in the rack
- Whether or not more than one router will be installed in the rack

You can install a single Cisco 12008 at any height in the rack, or you can “stack” as many as three routers in the rack to make maximum use of available rack space. Each installed router requires 25 inches of rack space (63.5 cm). The height of each router is 24.85 inches (63.1 cm), leaving a minimum of tolerance between each rack-mounted router.

In all cases, you should consider current and future equipment needs in determining the appropriate height for installing your router, while at the same time attempting to maintain as low a center of gravity as possible for all rack-mounted equipment.

If you choose not to install the mounting brackets, proceed to the following section entitled “Removing Components from the Router.”

To install the mounting brackets (see Figure 3-1), perform the following steps:

Step 1 Determine the proper height to install the mounting brackets in the rack.

To promote rack stability and a low center of gravity once the router is installed, attach the mounting brackets at the minimum practical height suitable to your equipment and cabling requirements.

Step 2 Position a mounting bracket on one of the posts at the desired level.

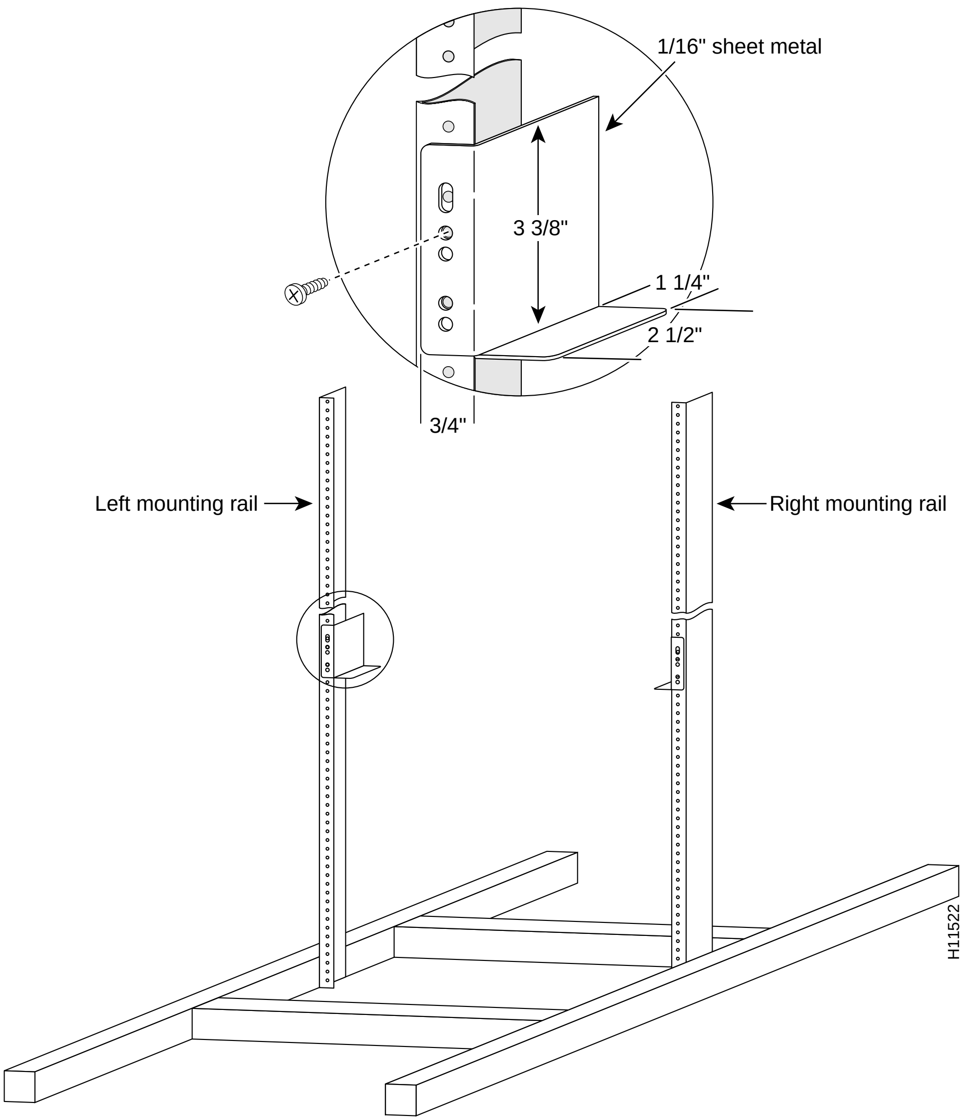
The mounting bracket is designed in a way that enables one of the lowest three holes in the bracket to match a hole in the mounting posts of the rack; the same is true for the highest three holes in the mounting bracket. Thus, you can secure the mounting bracket to the mounting post in the rack with two screws.

Step 3 Secure the bracket to the post using two screws provided in the accessory kit.

Step 4 Repeat Step 2 and Step 3 to secure a second mounting bracket on the opposite post, making sure that both brackets are installed at the same height.

Note If you intend to mount the router in a 4-post equipment rack, you have the option to install four mounting brackets on the posts. In this case, you can follow the general procedure outlined above to install the two additional mounting brackets.

Figure 3-1 Installing the Mounting Brackets (Telco-Style Rack Shown)



Removing Components from the Router

For the procedures in this section, it is assumed that you have unpacked the router, as instructed in the document *Cisco 12008 Gigabit Switch Router System Packing and Unpacking Instructions* posted on the outside of the shipping container.

It is assumed further that you have positioned the router near the intended installation site and that you have accomplished all other preparatory installation tasks, as described in Chapter 2, "Preparing for Installation."

A Cisco 12008 arrives in its shipping container configured as ordered, complete with power supplies and circuit boards. Since even a minimally configured system is quite heavy, it is strongly recommended that you remove the following components from the router before attempting to install it in a rack:

- Installed circuit boards in the upper card cage—Each circuit board and its associated card carrier weigh approximately 10 lb (4.54 kg).
- Installed power supply(ies)—The AC-input power supply weighs approximately 17 lb (7.73 kg); the DC-input power supply weighs approximately 14 lb (6.36 kg).

The card cage fan tray (12 lb), the power supply fan tray (2 lb), and the SFCs (2 lb each) in the lower card cage (if installed) contribute approximately 20 lb (9.1 kg) to the overall weight of the router; these components can be removed from the router at the discretion of the installer prior to mounting the router in the rack.

Removing Cards from the Upper Card Cage

The upper card cage, which forms an integral part of the router enclosure (see Figure 1-8), houses the following router components:

- One Route Processor (RP)
- One or two clock and scheduler cards (CSCs)
- Up to seven Cisco 12000 series line cards of any type and in any combination

This section contains procedures for removing these cards from the upper card cage preparatory to mounting the router enclosure in a rack.

Caution As you remove the cards from the upper card cage, place them on antistatic mats for ESD protection until they are reinstalled in the router.

Note Each line card has a vertical cable-management bracket affixed to it that enables you to neatly “dress” the network interface cables attached to line card ports. Leave this bracket in place when removing the line cards from the router. The RP and the CSC do not require vertical cable-management brackets.

To remove a card from the upper card cage, perform the following steps:

Step 1 Attach an antistatic ESD wrist strap to your wrist; ensure that it makes good contact with your skin.

Step 2 Insert the equipment end of the wrist strap (the banana jack) into the ESD connection socket near the lower left corner of the upper card cage. Figure 1-2 shows the location of this socket in the body of the router enclosure.

Step 3 Proceeding from left to right for all of the installed cards in the upper card cage, write down each card’s type and its location in the card cage.

Step 4 Starting with the left-most card, loosen the two captive installation screws located at the top and bottom of the card (see Figure 3-2a).

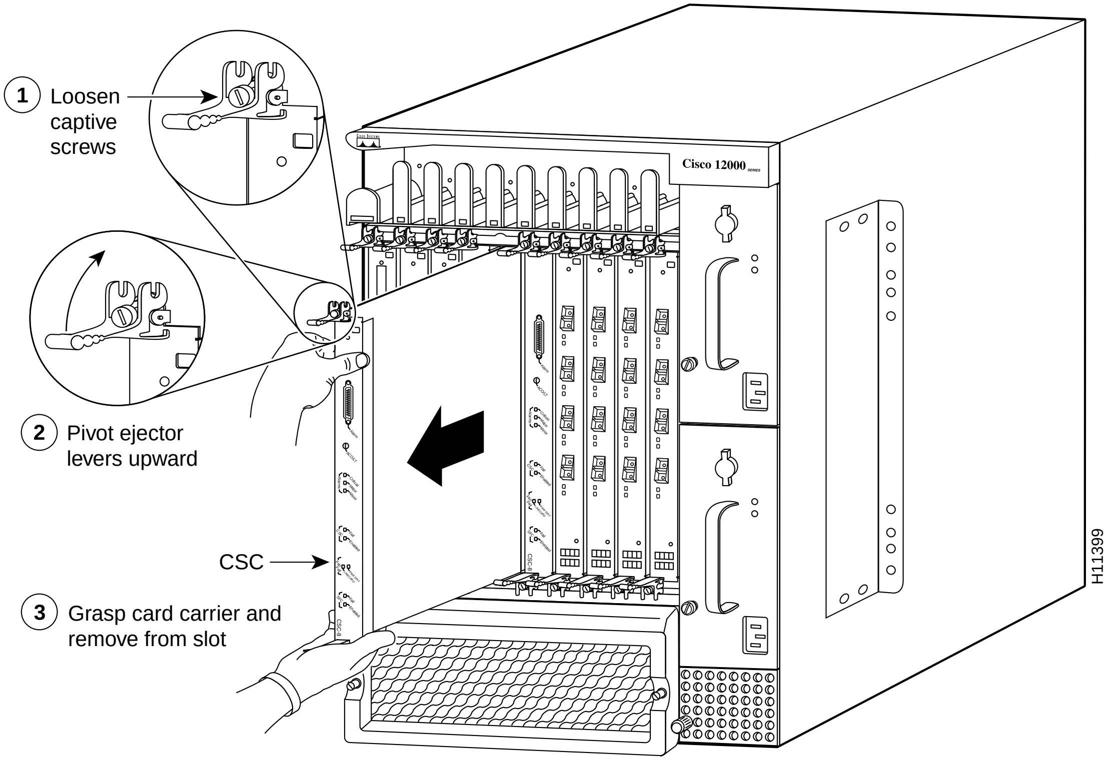
Step 5 Pivot the two card ejector levers away from the faceplate to unseat the card from the backplane (see Figure 3-2b).

Step 6 Touching only the metal card carrier and the card faceplate, slide the card out of its slot (see Figure 3-2c) and carefully place it (component side up) on an antistatic mat for ESD protection.

Note You need not remove any line card blanks that are installed in the upper card cage.

Go back to Step 3 and repeat the procedure as many times as necessary to completely depopulate the upper card cage. Stack the removed cards on the antistatic mat in their order of removal, thus leaving them properly ordered for later reinstallation.

Figure 3-2 Removing Cards from the Upper Card Cage (CSC Shown)



Removing a Power Supply from the Router

The router is shipped with all the circuit boards and the AC-input or the DC-input power supply(ies) already installed, as ordered, but without any cables connected.

To remove a power supply from the router, perform the following steps:

Step 1 Set the rotary power switch on each power supply, as follows:

- For an AC-input power supply—Set the switch to the Standby position.
- For a DC-input power supply—Set the switch to the OFF (O) position.

Note Turning the rotary power switch to the Standby position on the AC-input power supply is equivalent to setting the same switch on the DC-input power supply to the OFF position. In either case, turning the rotary power switch to the full counterclockwise position releases a mechanical interlock (latching mechanism), enabling you to remove the unit from the bay.

Step 2 Using a flat-blade screwdriver, turn the captive installation screw on the power supply faceplate counterclockwise until it is freed from the sheet metal flange of the power supply bay.

Step 3 Grasp the power supply carrying handle with one hand and pull the unit halfway out of the bay (see Figure 3-3).

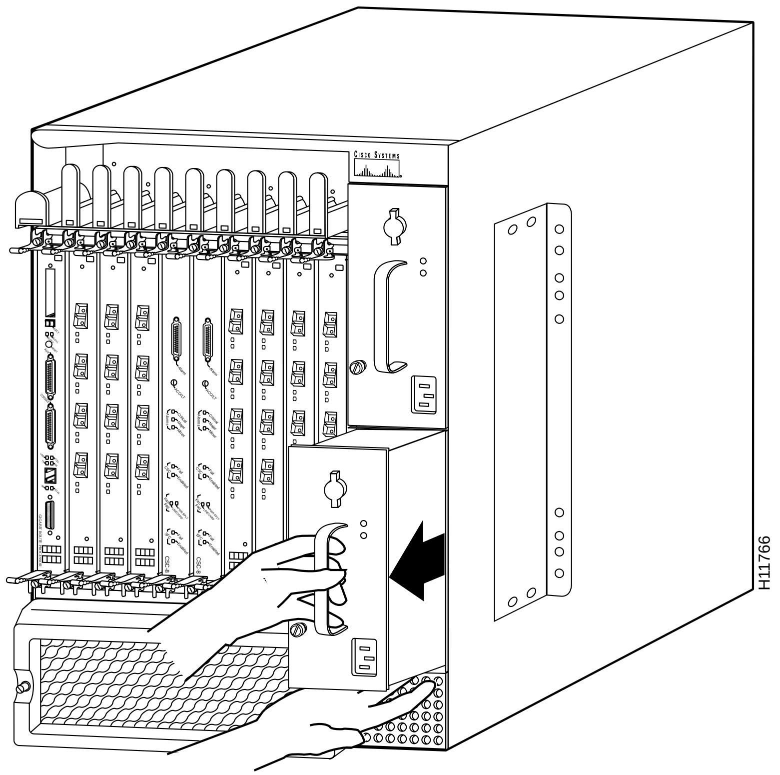
Caution Use both hands in removing a power supply.

Step 4 Place your free hand beneath the power supply to support its weight and slide the unit completely out of the bay.

Step 5 Set the power supply aside temporarily until you are ready to reinstall it following completion of the rack-mounting procedure described in the following section entitled “Rack-Mounting the Cisco 12008.”

Go back to Step 1 and repeat the procedure to remove the second power supply, if one is present.

Figure 3-3 Removing a Power Supply from the Router



Note If you ordered your system with a single AC-input or DC-input power supply, the system arrives with a power supply blank installed in the vacant power supply bay. Do not remove this blank panel in preparing to rack-mount the router.

If you intend to use your router with a single power supply of either type, the power supply blank must remain in place at all times for EMI compliance and to ensure that cooling air flows properly through the router.

Rack-Mounting the Cisco 12008

This section presents the procedures for mounting the Cisco 12008 in a rack.

For the purposes of this procedure, it is assumed that you have installed the two mounting brackets in a telco-style rack at the desired height in preparation for installing the router (see the earlier section entitled "Installing the Mounting Brackets"). It is also assumed that you have removed the power supplies and all of the components in the upper card cage to minimize the weight of the router.

Caution The Cisco 12008, including the backplane, the power supply fan trays, and the SFCs (if installed), weighs approximately 75 pounds (34.1 kg). For safety, a minimum of two people should install the router in the rack. To prevent injury when lifting the router, keep your back straight and lift with your legs.

To remove the router from the shipping pallet and mount it in a rack, perform the following steps:

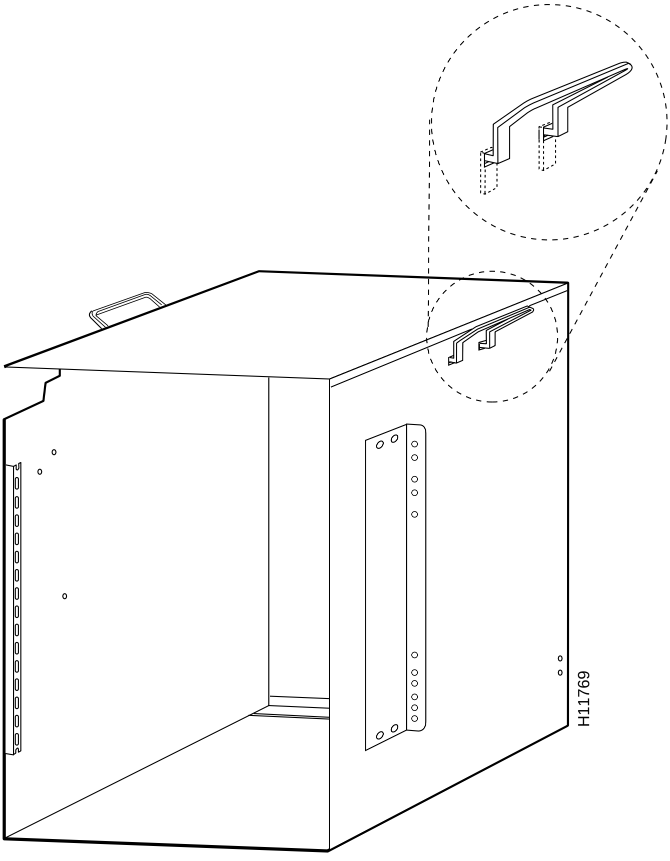
Step 1 Remove the four lag screws and retainer clips that secure the router to the shipping pallet.

Step 2 Affix the two lifting handles provided in the accessories box to the sides of the router enclosure, as shown in Figure 3-4.

Step 3 With one person standing at either side of the router, grasp the lifting handle affixed to the side of the router and lift the router off the shipping pallet.

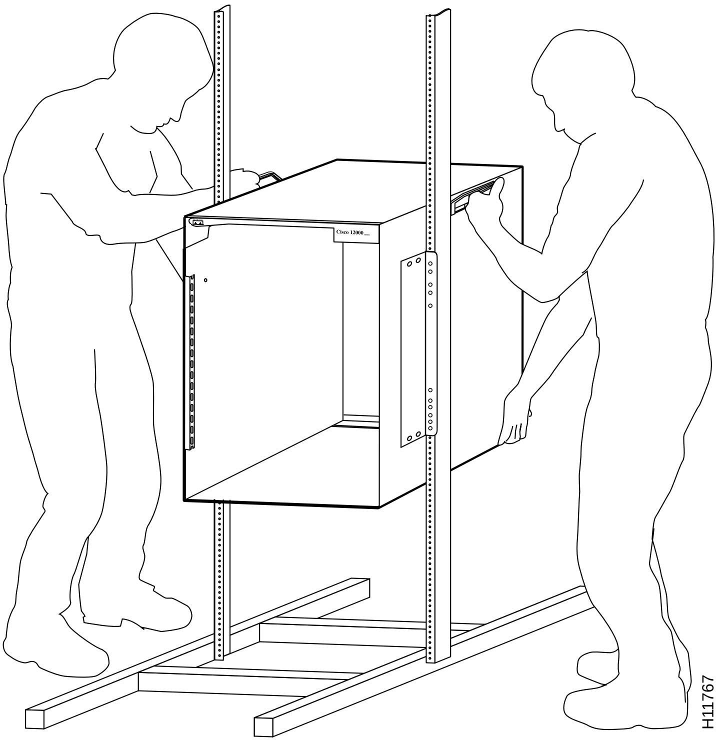
Step 4 With the assistance of a third person, position the router in the rack. Temporarily rest the weight of the router on the mounting brackets (see Figure 3-5).

Figure 3-4 Lifting Handles for the Cisco 12008



Note If you did not install the optional mounting brackets in the rack, two people must support the weight of the router while holding it in position for installation; a third person must then secure the router in the rack using the screws provided in the accessories box.

Figure 3-5 Installing the Router in the Rack



Step 5 Remove the two lifting handles from the side panels of the router before attempting to slide the router into the rack.

Step 6 Slide the router into the rack until the rack-mounting flanges on each side of the router rest against the rack-mounting posts.

Adjust the position of the router slightly, as necessary, to align two holes at both the top and the bottom of each rack-mounting flange on the router with corresponding holes in each mounting post.

In standard EIA and telco-style racks, the holes in each mounting post should align with the holes in each rack-mounting flange on the router, as follows:

- The pattern of holes at the top of the left and the right router mounting flanges should match at least two holes in each of the two mounting posts.
- The pattern of holes at the bottom of the left and the right router mounting flanges should match at least two holes in each of the two mounting posts.

Thus, to properly secure the router to the mounting posts in a telco-style rack, you should use a total of 8 screws—four per mounting flange.

Step 7 Secure the router to the mounting posts using the screws provided in the accessories box.

Reinstalling Components in the Router

This section presents the procedures for reinstalling the components removed from the router in preparation for rack mounting the chassis.

Reinstalling the Cards in the Upper Card Cage

Before attempting to reinstall the cards in the upper card cage, refer to the notes you made when you depopulated the upper card cage (see Step 3 in the section entitled "Removing Cards from the Upper Card Cage").

To replace a card in the upper card cage, perform the following steps:

Step 1 Attach an antistatic ESD wrist strap to your wrist; ensure that it makes good contact with your skin.

Step 2 Insert the equipment end of the wrist strap (the banana jack) into the ESD connection socket near the lower left corner of the upper card cage. Figure 1-2 shows the location of this socket in the body of the router enclosure.

Step 3 Select the top card from the antistatic mat. It is assumed that you will reinstall the cards in the upper card cage in reverse order. That is, the top card that you placed earlier on the antistatic mat should be the first card to be reinstalled in the router (see Step 6 in the section entitled "Removing Cards from the Upper Card Cage").

Step 4 Grasp the front edge of the metal card carrier with one hand and place your other hand under the carrier to support the card's weight and guide it into the card cage slot.

Note Alignment grooves at the top and bottom of each slot in the upper card cage help you to align the cards properly for insertion. Make sure you properly align the card carrier with these alignment grooves to facilitate card insertion.

Step 5 Carefully slide the card carrier into the slot until the ejector levers make contact with the top and bottom edges of the card cage.

Step 6 Grasp the line card ejector levers and pivot them toward the card faceplate until they are perpendicular to the faceplate. This action completely seats the card in the backplane.

Step 7 Tighten the two captive installation screws at the top and bottom of the card faceplate.

Go back to Step 3 and repeat the procedure until you have fully repopulated the upper card cage with the previously removed cards.

Note Card blanks must be installed in the upper card cage to cover any unoccupied slots. The card blanks help to maintain proper air flow through the router and ensure EMI compliance.

Reinstalling the Power Supplies in the Router

In this section, it is assumed that you will be reinstalling a power supply that you removed from the power supply bay in preparation for rack mounting the router (see the section entitled "Removing a Power Supply from the Router"). It is also assumed that the router has been mounted in the rack and that you are reinstalling the previously removed components.

The process of reinstalling a power supply is the reverse of the removal procedure depicted in Figure 3-3.

To reinstall a power supply that was removed prior to rack mounting the router, perform the following steps:

Step 1 Verify that the rotary power switch on the power supply to be reinstalled is set, as follows:

- For an AC-input power supply—Set to the Standby position.
- For a DC-input power supply—Set to the OFF position.

Note Turning the rotary power switch to the Standby position for the AC-input power supply is operationally equivalent to setting the same switch on the DC-input power supply to the OFF position. In either case, turning the rotary power switch to the full counterclockwise position retracts a mechanical interlock into the body of the power supply, thus enabling you to insert the power supply into the power supply bay.

Step 2 Grasp the power supply carrying handle with one hand.

Caution The AC-input power supply weighs 17 lb (7.72 kg); the DC-input power supply weighs 14 lb (6.36 kg). Use both hands when handling these units.

Step 3 While lifting the power supply by its carrying handle, place your free hand beneath the unit to support its weight.

Step 4 Position the power supply appropriately for insertion into the power supply bay.

Note If you are reinstalling only a single AC-input or DC-input power supply, it is recommended that you install the unit in the bottom bay.

Step 5 Gently slide the power supply into the bay until its faceplate meets the sheet metal flange of the power supply bay.

This action engages the blind mating connector at the rear of the power supply with its companion backplane connector.

Caution To prevent damage to the backplane, do not use excessive speed or force when sliding the power supply into the bay.

Step 6 Using a flat-blade screwdriver, turn the captive installation screw on the power supply faceplate clockwise until it is tight, thus securing the power supply in the bay.

Connecting the Line Card Cables

This section presents the procedures for installing the network interface cables in the cable-management system and attaching the cables to the appropriate line card ports.

The cable-management system consists of two components:

- A horizontal cable-management tray that is mounted directly above the upper card cage
- A vertical cable-management bracket that is attached to each line card

Additional line card installation information is contained in the configuration note that accompanies each line card that is shipped from the factory as an installed component or that is ordered and shipped separately as an FRU.

For example, for additional line card information, you can consult the appropriate configuration note(s) for the line card(s) installed in your router, as outlined below:

- Quad OC-3c/STM-1c Packet-Over-SONET (POS) line card—Refer to the document entitled *Quad OC-3c/STM-1c Packet-Over-SONET Line Card Installation and Configuration* (document number 78-4333-02).
- OC-12c/STM-4c Packet-Over-SONET (POS) line card—Refer to the document entitled *OC-12c/STM-4c Packet-Over-SONET Line Card Installation and Configuration* (document number 78-4341-02).
- OC-12c/STM-4c Asynchronous Transfer Mode (ATM) line card—Refer to the document entitled *OC-12c/STM-4c Asynchronous Transfer Mode Line Card Installation and Configuration* (document number 78-4344-02).

To install the network interface cables in the cable-management system and connect the cables to the line cards, perform the following steps:

Step 1 Attach an antistatic ESD wrist strap to your wrist; ensure that it makes good contact with your skin.

Step 2 Insert the equipment end of the wrist strap (the banana jack) into the ESD connection socket near the lower left corner of the upper card cage. Figure 1-2 shows the location of this socket in the body of the router enclosure.

Step 3 Beginning with the left-most line card in the upper card cage, identify the interface cables that attach to this line card.

Step 4 Select one interface cable at a time and carefully route it through the left end of the horizontal cable-management tray and down through the vertical cable-management bracket to the appropriate line card port.

Note On multiport line cards, the interface cables should be routed down through the vertical cable-management bracket to the appropriate ports on the card faceplate, starting with the bottom port and working upward.

Step 5 Starting with the bottom port (on multiport line cards only), connect the interface cable to the port (see Figure 3-6a).

Step 6 Carefully press the interface cable into the cable keeper clip nearest the port of connection (see Figure 3-6b).

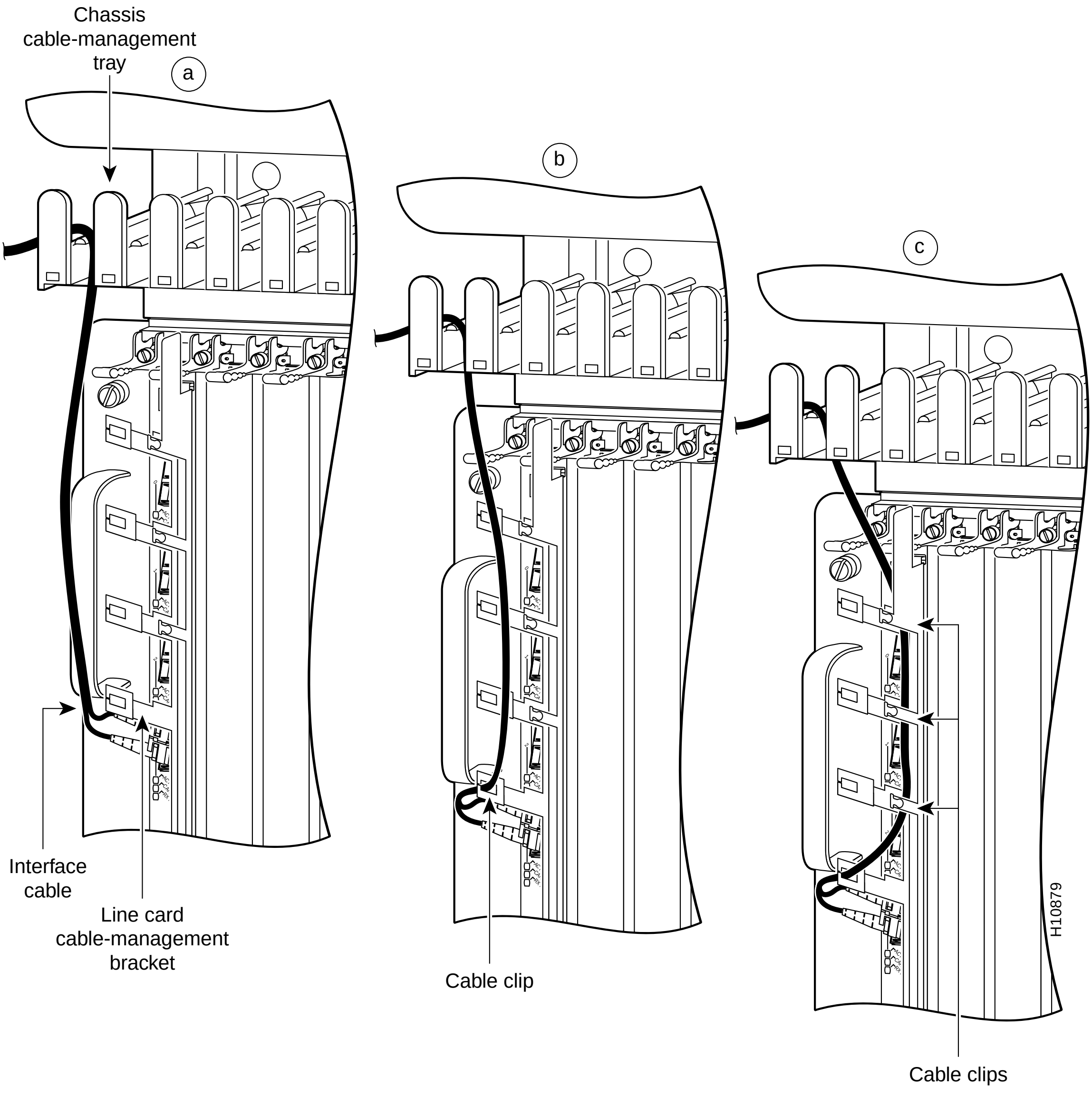
Make sure that you do not introduce any sharp bends or kinks into the cable in securing the cable to the keeper clip.

Step 7 Carefully press the cable into the bottom of the raceway in the vertical cable-management bracket (see Figure 3-6c).

Again, make sure that you do not introduce any kinks or sharp bends in the interface cable. The cable should lie in the bottom of the raceway without slack.

Step 8 Repeat the procedure in Step 4 through Step 7 for the remaining ports on the left-most line card.

Figure 3-6 Attaching Network Interface Cable to Line Card (Cisco 12012 Shown)



When you have completed installing the network interface cables on the left-most line card, proceed to the next card in turn in the upper card cage. Repeat this procedure until you have installed all of the network interface cables on all of the line cards present in the upper card cage.

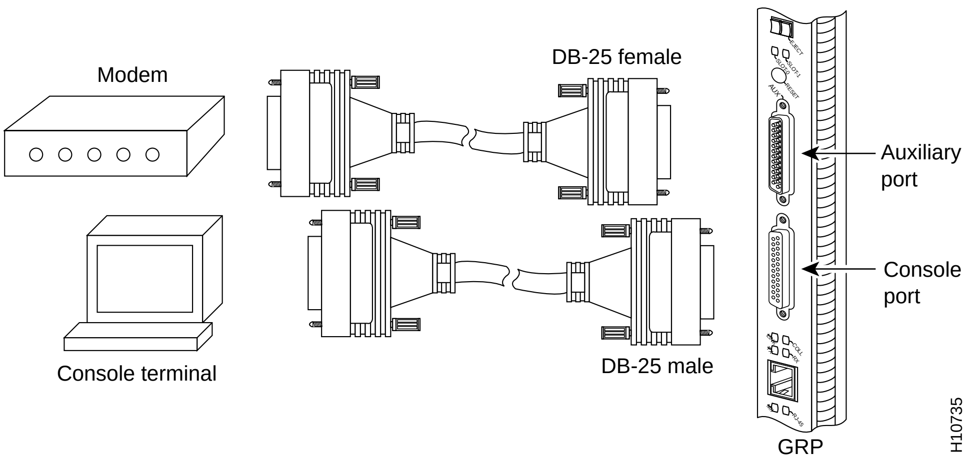
Connecting Route Processor Cables

The console and auxiliary ports for the Cisco 12008 are located on the RP. The GRP has an optional Ethernet port and the PRP has two Ethernet ports. This section contains connection equipment and pinout information for the console, auxiliary, and Ethernet ports on the GRP and PRP.

GRP Console and Auxiliary Port Connection Equipment

The GRP has two EIA/TIA-232 ports: a DCE-mode console port and a DTE-mode auxiliary port. The console port is a DCE DB-25 receptacle for connecting a console terminal, which you need to configure the Cisco 12008. The auxiliary port is a DTE DB-25 plug for connecting a modem or other DCE device (such as a channel service unit/data service unit (CSU/DSU) or other router) to the Cisco 12008 (see Figure 3-7).

Figure 3-7 Console and Auxiliary Port Connections



Note The console and auxiliary ports are asynchronous serial ports; any devices connected to these ports must be capable of asynchronous transmission. (Asynchronous is the most common type of serial device; for example, most modems are asynchronous devices.)

Note In order to maintain Class B EMI compliance, shielded cables must be used on the console and auxiliary ports of the GRP= and GRP-B=. An updated version of the GRP-B= board (Rev. F0) is available. This version does not require shielded cables for Class B compliance.

Before connecting a terminal to the console port, check your terminal's documentation to determine the baud rate of the terminal you plan to use. The baud rate of the terminal must match the default rate (9600 baud). Set up the terminal as follows: 9600 baud, 8 data bits, no parity, 2 stop bits (9600 8N2). You need an EIA/TIA-232 DCE console cable to connect the terminal to the console port. Cisco Systems does not provide console and auxiliary port cables; cables are available from commercial sources.

Note You must provide the EIA/TIA-232 cables to connect the terminal to the GRP console port or other devices to the auxiliary port. Cisco Systems does not provide console and auxiliary port cables; cables are available from other vendors. For compliance with GR-1089 (intra-building surge), you must use shielded cables on the GRP console and auxiliary ports.

Because the connectors on some standard cables are tall enough to interfere with the front covers installed on the card cages, Cisco includes a lower-profile cable adapter that permits you to connect a flat cable with modular RJ-45 plugs to the GRP console port.

For console and auxiliary port pinouts, refer to Table 3-1 and Table 3-2, respectively.

GRP Console Port Signals

Both Data Set ready (DSR) and Data Carrier Detect (DCD) signals are active when the system is running. The console port does not support modem control or hardware flow control. The console port requires a straight-through EIA/TIA-232 cable. Table 3-1 lists the signals used on this port

Table 3-1 GRP Console Port Signals

Pin	Signal	Direction	Description
1	GND	–	Ground
2	TxD	Output	Transmit Data
3	RxD	Input	Receive Data
6	DSR	Input	Data Set Ready (always on)
7	GND	–	Ground
8	DCD	Input	Data Carrier Detect (always on)
20	DTR	Output	Data Terminal Ready

GRP Auxiliary Port Signals

The auxiliary port on the GRP is a DB-25 plug DTE port for connecting a modem or other DCE device (such as a CSU/DSU or other router) to the Cisco 12008. The port is located above the console port on the GRP faceplate. The auxiliary port supports hardware flow control and modem control. An example of a modem connection is shown in Figure 3-7. Table 3-2 lists the signals used on the auxiliary port.

Table 3-2 Auxiliary Port Signals

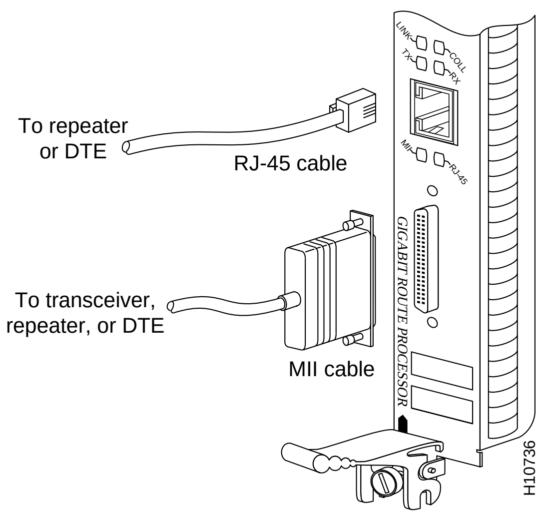
Pin	Signal	Direction	Description
1	Signal Ground	–	Signal Ground
2	TxD	Output	Transmit Data
3	RxD	Input	Receive Data
4	RTS	Output	Request To Send (used for hardware flow control)
5	CTS	Input	Clear To Send (used for hardware flow control)
6	DSR	Input	Data Set Ready
7	Signal Ground	–	Signal Ground
8	CD	Input	Carrier Detect (used for modem control)
20	DTR	Output	Data Terminal Ready (used for modem control only)
22	RING	Input	Ring

GRP Ethernet Connection Equipment

The Ethernet port on the GRP has both a media independent interface (MII), 40-pin, D-shell type receptacle and a media dependent interface (MDI) RJ-45 receptacle that are capable of data transmission rates from 10 and 100 megabits per second (Mbps). (See Figure 3-8.)

Note At the auto-sensed data transmission rate of 100 Mbps, the Ethernet port provides maximum usable bandwidth that is less than 100 Mbps; a maximum usable bandwidth of approximately 20 Mbps should be expected from either the RJ-45 or MII connections. Transmission speed is determined by the network to which the Ethernet interface is connected and is not user-configurable.

Figure 3-8 RJ-45 and MII Ethernet Connections



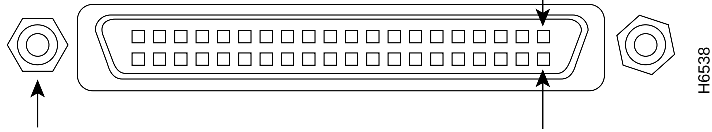
Both the MII and RJ-45 receptacles support IEEE 802.3u Ethernet interfaces compliant with the 100Base-TX and 10Base-T standards. The MII receptacle requires an external transceiver that permits connection to multimode fiber for 100Base-FX or 100Base-T4 physical media. Only one Ethernet receptacle, either RJ-45 or MII, can be used at a time. Two LEDs on the GRP faceplate show which Ethernet receptacle is active.

Note The Ethernet port can use either unshielded twisted-pair or screened twisted-pair cables. In sites where extremely high immunity to noise is required, screened twisted-pair cable is recommended.

Depending on the type of media you use between the MII receptacle and your switch or hub, the network side of your 100-Mbps transceiver should be appropriately equipped with ST-type connectors (for optical fiber), BNC connectors, and so forth.

Figure 3-9 shows the pin orientation of the female MII receptacle on the Ethernet port.

Figure 3-9 Ethernet MII Receptacle



The MII receptacle uses 2-56 screw-type locks, called jackscrews, to secure the cable or transceiver to the MII port. MII cables and transceivers have knurled thumbscrews that you fasten to the jackscrews on the MII connector and tighten with your fingers. Use the jackscrews to secure your MII cable to the MII receptacle.

Table 3-3 lists the signals used on the MII receptacle, and Table 3-4 lists the signals used on the RJ-45 receptacle.

Table 3-3 Ethernet MII Pinout

Pin[1]	In	Out	Input/Output	Description
14–17	–	Yes	–	Transmit Data (TxD)
12	Yes	–	–	Transmit Clock (Tx_CLK)[2]
11	–	Yes	–	Transmit Error (Tx_ER)
13	–	Yes	–	Transmit Enable (Tx_EN)
3	–	Yes	–	MII Data Clock (MDC)
4–7	Yes	–	–	Receive Data (RxD)
9	Yes	–	–	Receive Clock (Rx_CLK
10	Yes	–	–	Receive Error (Rx_ER)

Table 3-3 Ethernet MII Pinout (Continued)

Pin[1]	In	Out	Input/Output	Description
8	Yes	–	–	Receive Data Valid (Rx_DV)
18	Yes	–	–	Collision (COL)
19	Yes	–	–	Carrier Sense (CRS)
2	–	–	Yes	MII Data Input/Output (MDIO)
22–39	–	–	–	Common (ground)
1, 20, 21, 40	–	–	–	+5.0 volts (V)

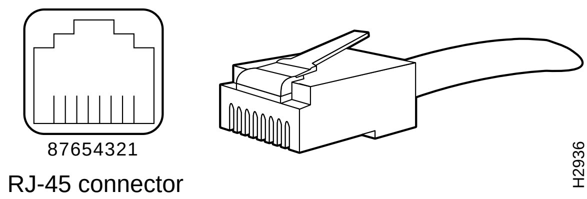
1. Any pins not indicated are not used.
2. Tx_CLK and Rx_CLK are provided by the external transceiver.

Table 3-4 Ethernet RJ-45 Pinout

Pin	Signal
1	TX+
2	TX–
3	RX+
4	Termination Network
5	Termination Network
6	RX–
7	Termination Network
8	Termination Network

Figure 3-10 shows the pin orientation of the female RJ-45 receptacle on the Ethernet port.

Figure 3-10 Ethernet RJ-45 Receptacle



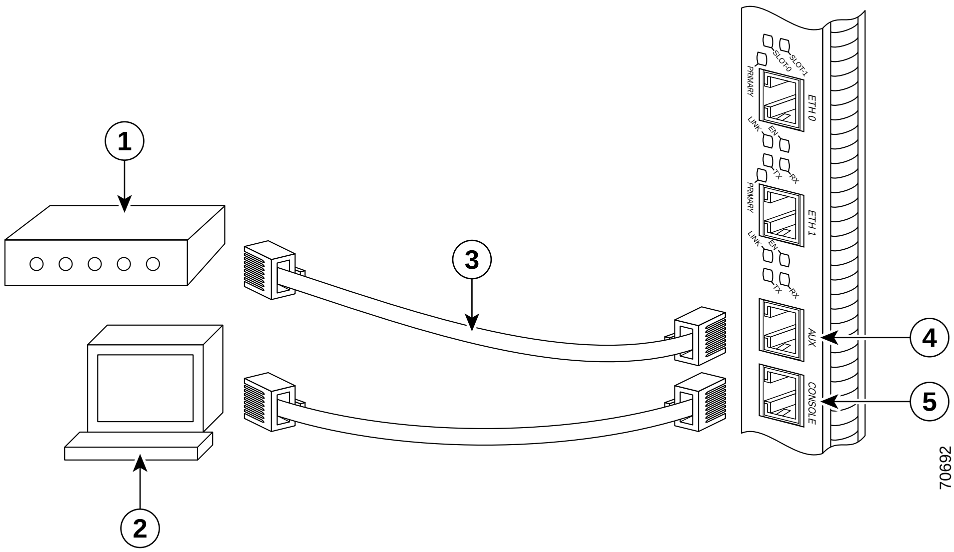
Warning The ports labeled “Ethernet,” “10BASE-T,” “Token Ring,” “Console,” and “AUX” are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits.

PRP Console and Auxiliary Port Connection Guidelines

The system console port on the PRP is a DCE RJ-45 receptacle for connecting a data terminal, which you must configure. The console port is labeled *Console*, as shown in Figure 3-11. Before connecting the console port, check your terminal’s documentation to determine the baud rate of the terminal you plan to use.

The baud rate of the terminal must match the default baud rate (9600 baud). Set up the terminal as follows: 9600 baud, 8 data bits, no parity, and 2 stop bits (9600, 8N2). The console port requires a straight-through RJ-45 cable.

Figure 3-11 PRP Console and Auxiliary Port Connections



1	Modem	**4**	Auxiliary port
2	Console terminal	**5**	Console port
3	RJ-45 Ethernet cables		

Note The console and auxiliary ports are both asynchronous serial ports; any devices connected to these ports must be capable of asynchronous transmission. (Asynchronous is the most common type of serial device; for example, most modems are asynchronous devices.)

PRP Console Port Signals

The console port on the PRP is a DCE RJ-45 receptacle. Table 3-5 lists the signals used on this port.

Table 3-5 PRP Console Port Signals

Console Port Pin	Signal	Input/Output	Description
1[1]	—	—	—
2	DTR	Output	Data Terminal Ready
3	TxD	Output	Transmit Data
4	GND	—	Signal Ground
5	GND	—	Signal Ground
6	RxD	Input	Receive Data
7	DSR	Input	Data Set Ready
8[1]	—	—	—

1. These pins are not connected.

PRP Auxiliary Port Signals

The auxiliary port on the PRP is a DTE, RJ-45 plug for connecting a modem or other DCE device (such as a CSU/DSU or another router) to the router. The port is labeled *Aux*, as shown in Figure 3-11. The asynchronous auxiliary port supports hardware flow control and modem control. Table 3-6 lists the signals used on the auxiliary port.

Table 3-6 PRP Auxiliary Port Signals

Auxiliary Port Pin	Signal	Input/Output	Description
1	RTS	Output	Request To Send
2	DTR	Output	Data Terminal Ready
3	TxD	Output	Transmit Data
4	GND	—	Signal Ground
5	GND	—	Signal Ground

Table 3-6 PRP Auxiliary Port Signals (Continued)

Auxiliary Port Pin	Signal	Input/Output	Description
6	RxD	Input	Receive Data
7	DSR	Input	Data Set Ready
8	CTS	Input	Clear To Send

PRP Ethernet Connection Equipment

There are two RJ-45 Ethernet interface receptacles on the PRP, providing media-dependent interface (MDI) Ethernet ports. These connections support IEEE 802.3 and IEEE 802.3u interfaces compliant with 10BASE-T and 100BASE-TX standards. The transmission speed of the Ethernet ports is auto-sensing by default and is user configurable.

The RJ-45 receptacles on the PRP provide two physical connection options for Ethernet interfaces. RJ-45 cables are not available from Cisco Systems; they are available from outside commercial cable vendors. To connect cables to the PRPs Ethernet interfaces (ports labeled *ETH0* and *ETH1*), attach the Category 5 UTP cable directly to a RJ-45 receptacle on the PRP.

The Ethernet interfaces on the PRP are end-station devices, not repeaters; therefore, you must connect an Ethernet interface to a repeater or hub.

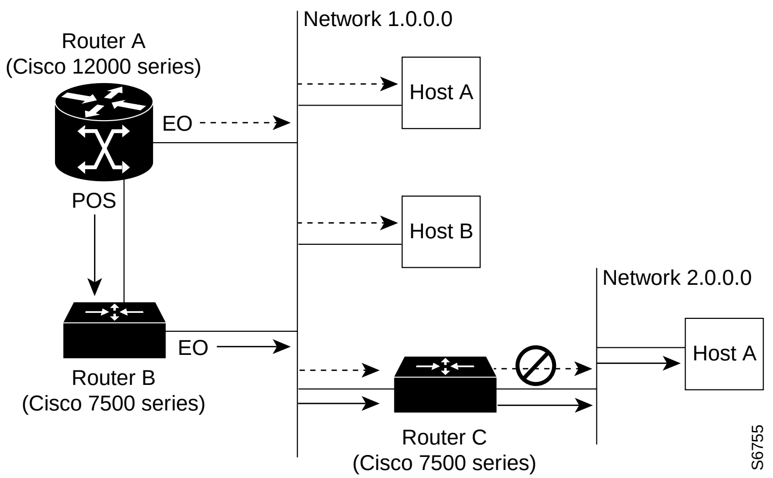
Note Only connect cables that comply with EIA/TIA-568 standards. (See Table 3-7 and Table 3-9 for cable recommendations and specifications.)

Caution The Ethernet ports are primarily used as a Telnet port into the Cisco 12000 series Internet Router, and for booting or accessing Cisco IOS software images over a network to which an Ethernet port is directly connected. Cisco Express Forwarding (CEF) functions are switched off by default for security reasons. Cisco strongly cautions you to consider the security implications of switching on CEF routing functions on these ports.

Figure 3-12 shows an example of the functionality of an Ethernet port. In this example, you cannot access Network 2.0.0.0 via the Ethernet port (ETH0) on the PRP in Router A; you can only access the hosts and Router C, which are in Network 1.0.0.0. (See dotted arrows in Figure 3-12.)

To access Network 2.0.0.0 from Router A, you must use an interface port on one of your line cards (in this example, a Packet-over-SONET (POS) line card in Router A) to go through Router B, through Router C, and into Network 2.0.0.0. (See solid arrows in Figure 3-12.)

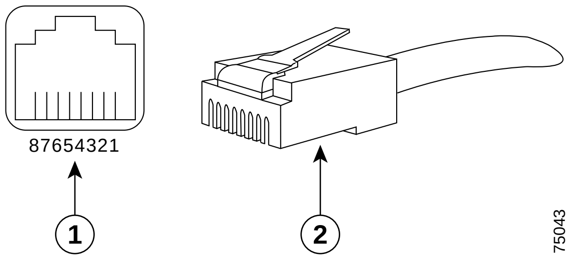
Figure 3-12 Using the Ethernet Port on the PRP



PRP Ethernet Connections

Figure 3-13 shows a PRP RJ-45 receptacle and cable connectors. The RJ-45 connection does not require an external transceiver. The RJ-45 connection requires Category 5 unshielded twisted-pair (UTP) cables, which are not available from Cisco Systems, but are available from commercial cable vendors. Table 3-7 lists the pinout for the RJ-45 receptacle.

Figure 3-13 RJ-45 Receptacle and Plug (Horizontal Orientation)



1	RJ-45 receptacle	**2**	Category 5 UTP cable with plug

Warning The ports labeled Ethernet, 10BASE-T, Token Ring, Console, and AUX are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits.

Table 3-7 PRP RJ-45 Ethernet Receptacle Pinout

Ethernet Port Pin	Signal	Description
1	TxD+	Transmit data +
2	TxD–	Transmit data –
3	RxD+	Receive data +
4	Termination Network	No connection
5	Termination Network	No connection
6	RxD–	Receive data –
7	Termination Network	No connection
8	Termination Network	No connection

Depending on your RJ-45 cabling requirements, use the cable pinouts shown in Figure 3-14 or Figure 3-15.

Figure 3-14 Straight-Through Cable Pinout (Connecting MDI Ethernet Port to MDI-X Wiring)

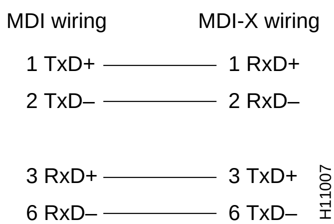


Figure 3-15 Crossover Cable Pinout (for Connecting Two PRPs)

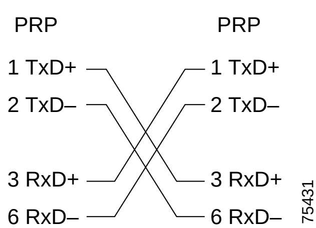


Table 3-8 lists the cabling specifications for 100-Mbps transmission over unshielded twisted-pair (UTP) cables.

Note The transmission speed of the Ethernet ports is auto-sensing by default and is user configurable.

Table 3-8 Specifications and Connection Limits for 100-Mbps Transmission

Parameter	RJ-45
Cable specification	Category 5[1] UTP, 22 to 24 AWG[2]
Cable length (max)	—
Segment length (max)	328 feet (100 m) for 100BASE-TX
Network length (max)	656 feet (200 m)[3] (with 1 repeater)

1. EIA/TIA-568 or EIA-TIA-568 TSB-36 compliant. Not supplied by Cisco.
2. AWG = American Wire Gauge. This gauge is specified by the EIA/TIA-568 standard.
3. This length is specifically between any two stations on a repeated segment.

Table 3-9 lists IEEE 802.3u physical characteristics for 100BASE-TX.

Table 3-9 IEEE 802.3u Physical Characteristics

Parameter	100BASE-TX
Data rate (Mbps)	100
Signaling method	Baseband
Maximum segment length	100 m between DTE[1] and repeaters
Media	Category 5 UTP (for RJ-45)
Topology	Star/Hub

1. DTE = data terminal equipment.

Connecting an External Alarm Monitoring Facility

The clock and scheduler card (CSC) incorporates a 25-pin D-sub connector on the card faceplate (see Figure 3-16) that enables you to attach a site-wide external alarm monitoring facility to the Cisco 12008. This facility is described in Chapter 1 in the section entitled “Housekeeping and Alarm Monitoring Functions of the CSC.”

The alarm signals sent to this DB-25 connector correspond to those sent to the system alarm LEDs on the CSC faceplate (see Figure 3-16). Thus, a critical, major, or minor alarm condition detected in the router can trigger a simultaneous fault indication in some or all of the following ways:

- System alarm LEDs—The three system alarm LEDs on the CSC faceplate constitute the standard method of alarm notification in the router.

  These LEDs indicate router status at all times, but you must directly observe these LEDs to become aware of a router alarm condition. Thus, these LEDs provide only a passive alarm notification capability.

- External alarm monitoring facility—By equipping your router with a telco-style external alarm monitoring facility, you can provide a more overt indication of router status.

  For example, the same alarm signal that illuminates one of the three system alarm LEDs on the CSC faceplate for a critical, major, or minor alarm condition is also sent to the DB-25 connector by means of an associated alarm relay in the CSC.

  An external alarm monitoring facility uses this signal to activate a visible alarm (such as a flashing light) or an audible alarm (such as a Klaxon) that immediately alerts site personnel to the existence of a router alarm condition.

Figure 3-16 DB-25 Connector and System Alarm LEDs on the CSC

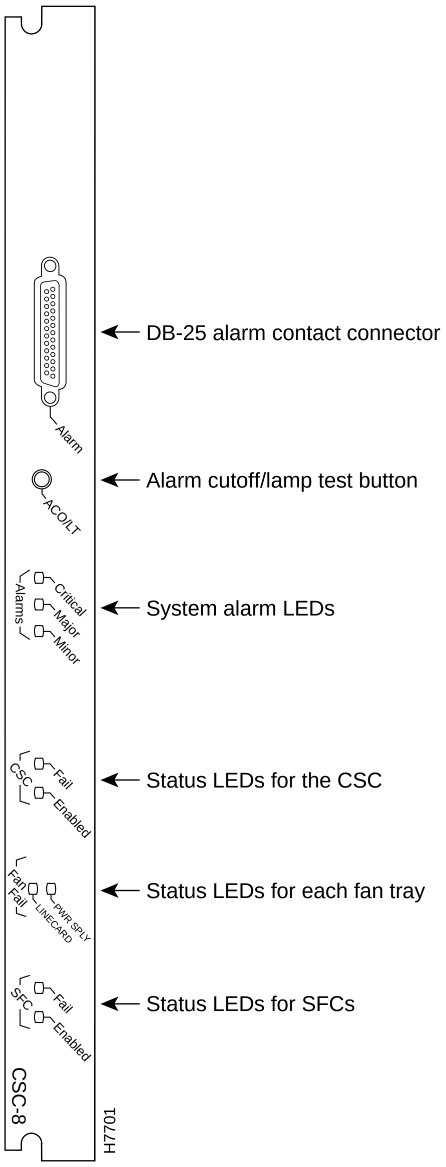
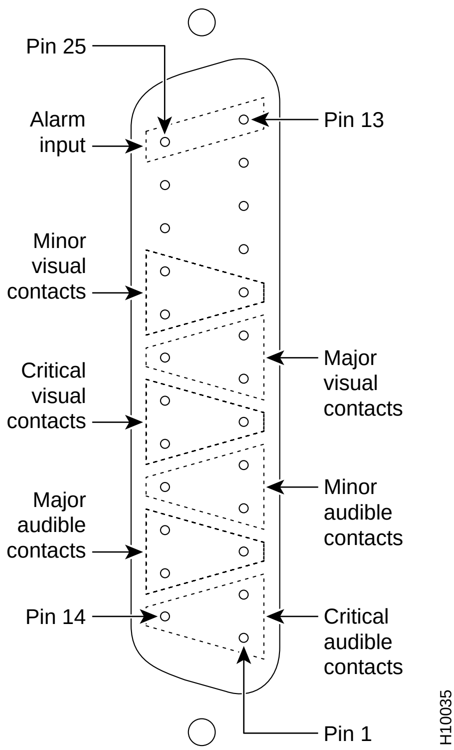


Figure 3-17 shows an expanded view of the DB-25 connector on the CSC faceplate.

Figure 3-17 Expanded View of the DB-25 Connector



DB-25 Female connector

Table 3-10 lists the common, normally open, and normally closed relay contacts accessible to an external alarm monitoring facility by means of the DB-25 connector.

Table 3-10 DB-25 Connector Pinout Assignments

Pin Group	Common	Normally Open	Normally Closed
Critical audible alarm	2	1	14
Major audible alarm	16	3	15
Minor audible alarm	5	4	17
Critical visible alarm	19	6	18
Major visible alarm	8	7	20
Minor visible alarm	22	9	21
Alarm input	13	25	

Note Only safety extra-low voltage (SELV) circuits can be connected to the DB-25 connector. The maximum current rating for the DB-25 connector is 1A at 60 VDC.

Connecting System Ground

This section presents the procedures for connecting the Cisco 12008 to earth ground. It is strongly recommended that you complete this procedure before connecting system power or turning on your router.

Figure 3-18 shows the location of the grounding holes on the side panel of the router. Matching holes appear in the opposite side panel, enabling you to attach the grounding cable to either one side of the router or the other, but not both.

To ensure that the system grounding connection is adequate, you need the following parts and tools:

- Two 2-hole grounding lugs—These grounding lugs must have two M6 (metric) screw holes centered 0.625-inch to 0.75-inch apart and have a wire receptacle large enough to accommodate the recommended 4-AWG, multistrand, copper wire.

  The grounding lugs can be similar to the terminals used with the source DC power cables for the DC-input power supply (see Figure 2-6).

These grounding lugs are not available from Cisco Systems; they are common items that can be obtained from any electrical equipment vendor, such as Panduit.

- Four Phillips head, M6 (metric) machine screws with locking washers and nuts—This mounting hardware is not available from Cisco Systems; it can be obtained readily from any commercial electrical equipment vendor.
- Two grounding wires—It is recommended that you use 4 AWG, 0.204-inch (5.18-mm) diameter wire for grounding purposes. However, you may use a grounding wire of smaller gauge. The actual wire diameter and length depend on your router location and the installation environment.

  This grounding wire is not available from Cisco Systems; it is commonly available from commercial cable vendors.
- Number 2 Phillips head screwdriver.
- A 1/4-inch flat-blade screwdriver (to loosen/tighten the captive installation screws at the bottom of the rear access cover of the router)
- Crimping tool—This tool must be large enough to accommodate the girth of the grounding lug when you crimp the grounding cable into the lug.
- Wire stripping tool.

To attach the grounding lug and cable to the grounding receptacle on the Cisco 12008, perform the following steps:

Step 1 Use a wire-stripping tool to remove approximately 0.75 inch (19 mm) of the covering from the end of the grounding wire.

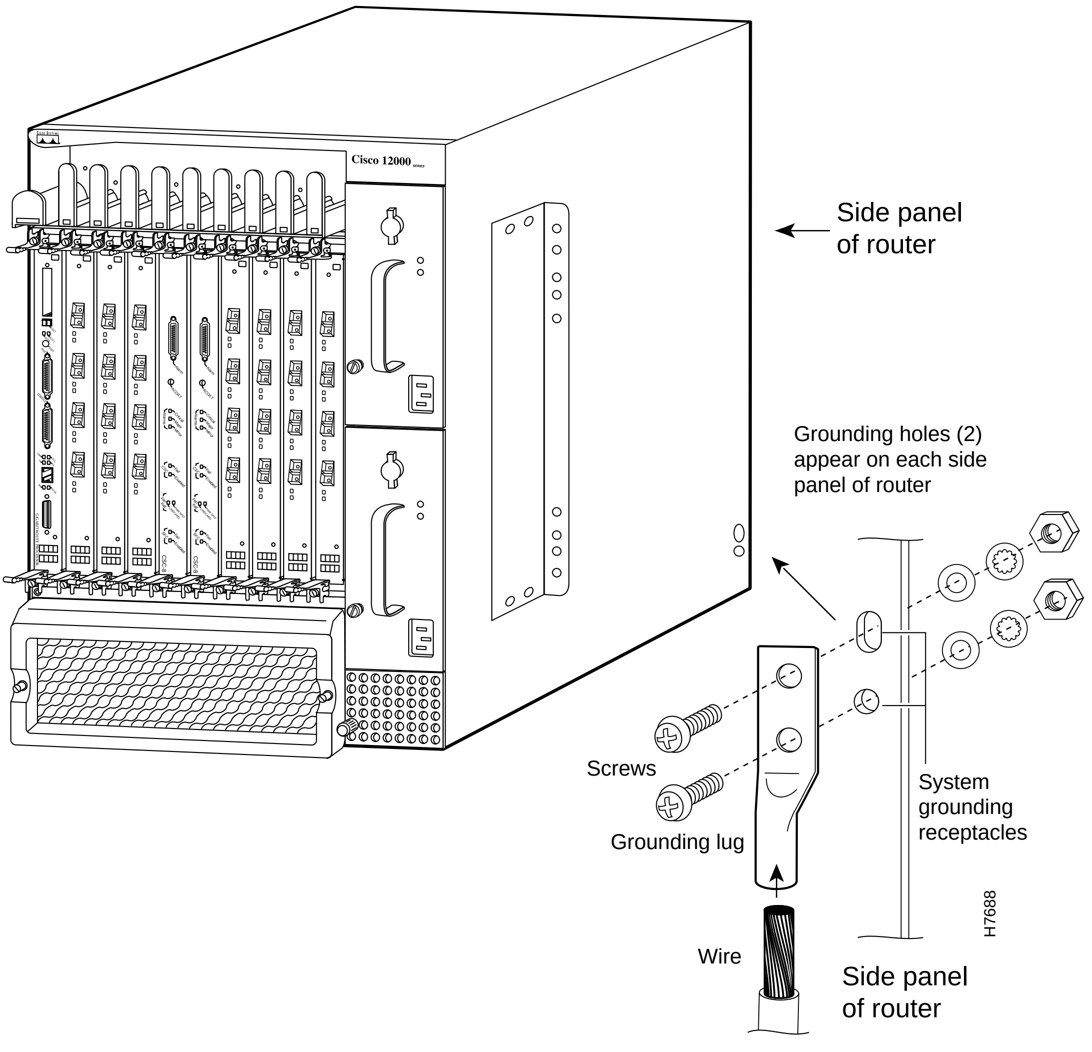
Step 2 Insert the stripped end of the grounding wire into the open end of the grounding lug.

Step 3 Use the crimping tool to secure the grounding wire in place in the grounding lug.

Step 4 Using a 1/4-inch flat-blade screwdriver, remove the rear access cover of the router. To do so, loosen the two captive installation screws at the bottom of the cover; pivot the cover up and away from the router to release the three access cover tabs from their slots. Set the access cover aside temporarily.

Step 5 Locate the grounding receptacle on the side panel of the router (see Figure 3-18).

Figure 3-18 Connecting System Ground on the Cisco 12008



Step 6 Place the grounding lug against the grounding receptacle on the side panel of the router.

Step 7 Insert two screws through the holes in the grounding lug and the grounding receptacle. Ensure that the grounding lug will not interfere with other router hardware or rack equipment.

Step 8 Install the locking washers and nuts; tighten them to secure the grounding lug to the grounding receptacle.

Step 9 Reinstall the rear access cover on the router. To do so, insert the three tabs of the access cover into their corresponding slots in rear of the router enclosure; pivot the cover downward until it rests against the bottom of the router enclosure. Using a 1/4-inch flat-blade screwdriver, tighten the two captive installation screws in the bottom of the rear cover to securely fasten the cover in place.

Note If you remove the rear access cover temporarily for any reason, be sure you reinstall it and secure it in place by firmly tightening the captive installation screws with a screwdriver. Doing so prevents casual removal of the access cover without the use of a tool.

Step 10 Prepare the other end of the grounding wire and connect it to an appropriate grounding point in your site to ensure adequate earth ground for the router.

Connecting Source Power to the Power Supplies

This section presents the procedures for applying source power to either an AC-input power supply or a DC-input power supply. It is assumed that you have already installed one or two AC-input power supplies or one or two DC-input power supplies, and that your task now is to connect source power to them.

Note You should not install two power supplies of either type unless you intend to use both units. In other words, you should not install two power supplies and power the router with only one of the units. Powering the router with a single power supply while using the other bay to “store” an inert unit may disrupt the normal flow of cooling air through the power supply bays.

Depending on the power supply type installed in your router, refer to one of the two following sections for instructions on connecting source power to the power supply.

Note Detailed instructions for installing or replacing power supplies are also contained in the configuration notes entitled *Cisco 12008 Gigabit Switch Router AC-Input Power Supply Replacement Instructions* (document number 78-4954-01) and *Cisco 12008 Gigabit Switch Router DC-Input Power Supply Replacement Instructions* (document number 78-4955-01). A configuration note accompanies each power supply that is ordered and shipped from the factory as a field-replaceable unit (FRU). These configuration notes are also available on the Cisco Documentation CD and on Cisco Connection Online (CCO).

Connecting Source Power to an AC-Input Power Supply

In the following procedure, you are assumed to have an AC-input power supply already installed in your router; you need to connect it to an AC power source. If an AC-input power supply is not already installed, perform the procedures in the earlier section entitled “Reinstalling the Power Supplies in the Router” before attempting to connect source AC power to the unit.

If you equip your router with a single AC-input power supply, install it in the bottom power supply bay.

Note All electrical connections between the power supply and the backplane are accomplished automatically when the power supply is installed in the power supply bay.

To connect source power to an AC-input power supply, perform the following steps:

Step 1 Verify that the rotary power switch on the power supply is in the Standby (OFF) position.

Note A power supply bay not occupied by a power supply must have a power supply blank installed for EMI compliance and to ensure proper airflow through the router.

Step 2 Locate the AC power cord shipped with your system and verify that it is the correct type for your particular site.

For this purpose, refer to the section in Chapter 2 entitled “AC-Powered Systems.”

Note If the proper power cord was not shipped with your system, contact your service representative.

Step 3 First ensure that the bail latch is pushed down; then plug the AC power cord into the AC receptacle on the power supply faceplate (see Figure 3-19).

Note If you have a redundant AC-input power supply configuration, we recommend that you connect each power supply to an independent AC power source and install an uninterruptable power source (UPS) in your site to protect your router against power failure. Each AC-input power supply operating between 200 VAC and 240 VAC requires a dedicated 20A service.

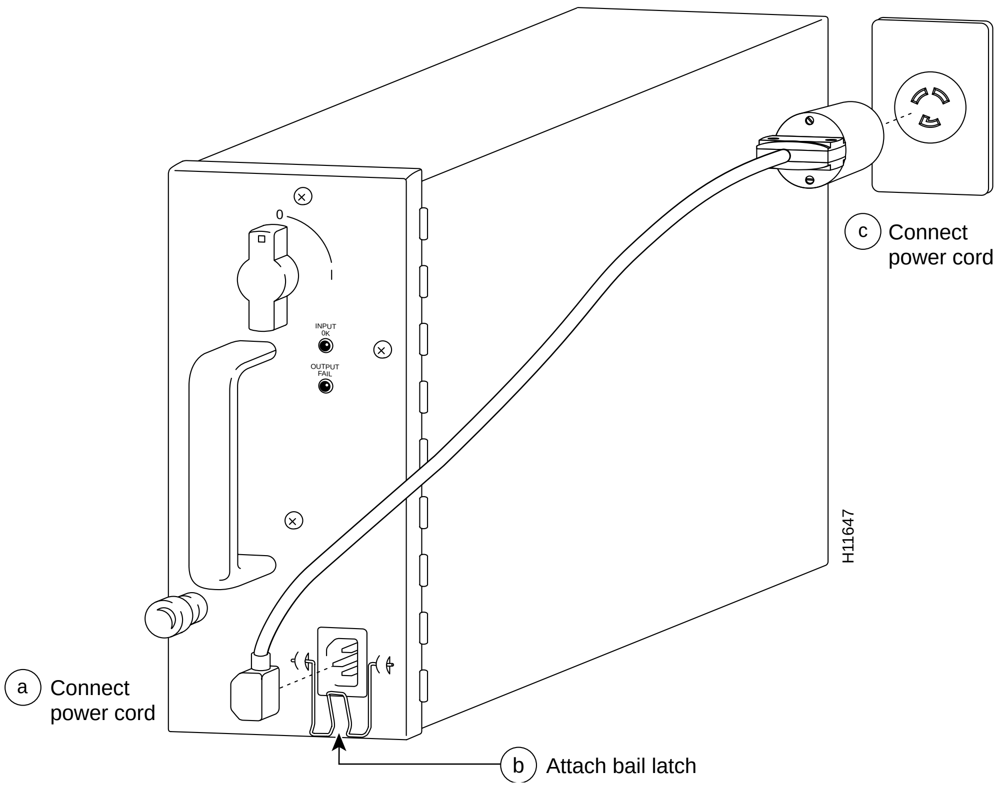
Step 4 Position the bail latch over the power cord plug by pulling the latch up and over the plug to secure the plug in the AC receptacle on the power supply faceplate (see Figure 3-19).

Step 5 Connect the other end of the AC power cord to the source AC outlet for your site (see Figure 3-19).

Step 6 Go back to Step 1 and repeat the procedure to connect source AC power to the second (redundant) AC-input power supply, if one is present.

Caution At this time, *do not* turn the rotary power switch to the ON (|) position on either a single or a redundant AC-input power supply.

Figure 3-19 Connecting a Source AC Power Cord to an AC-Input Power Supply



Step 7 Turn on the source AC circuit breaker that services the AC-input power supply(ies).

Before applying power to your Cisco 12008, go to the section entitled “Starting the Cisco 12008.”

Connecting Source Power to a DC-Input Power Supply

In the following procedure, you are assumed to have a DC-input power supply already installed in your router; you need to connect it to a DC power source. If a DC-input power supply is not already installed, perform the procedures in the earlier section entitled “Reinstalling the Power Supplies in the Router” before attempting to connect source DC power to the unit.

If you equip your router with a single DC-input power supply, install it in the bottom power supply bay.

Note An unoccupied power supply bay must have a power supply blank installed to ensure EMI compliance and the proper flow of cooling air through the router.

Before attempting to connect your DC-input power supply to a DC power source, ensure that your site meets the following requirements:

- DC power service—A dedicated 40A service must be available for each DC-input power supply.
- Power cables (three per power supply)—The power cables must have the following characteristics:
  - Size—4 AWG (recommended)
  - Diameter—0.204-inch (5.18-mm)
  - Construction—High-strand-count copper wire

  The length of the power cable depends on the location of your router within the site and the proximity of source DC power to the router.
- Power lugs (one for each of the three power cables)—The lugs for the power cables must have the following characteristics:
  - Contain dual holes centered 0.625-inch apart
  - Be able to fit over M6 (metric) threaded terminal studs on the router faceplate
  - Be made of copper (not aluminum) with electro-tin plating for corrosion resistance; equivalent power lugs are acceptable

Also, before attempting to connect source power to a DC-input power supply, review the content of the section in Chapter 2 entitled “DC-Powered Systems,” which deals with the following topics:

- Specifications for source DC input power (see Table 1-10 in Chapter 1)
- Specifications of the source DC power cable and lug (see Table 2-2 in Chapter 2)
- Dimensions of the lugs used with the source DC power cables (see Figure 2-6 in Chapter 2)

To connect source power to a DC-input power supply, perform the following steps:

Step 1 Verify that the rotary power switch on the DC-input power supply is in the OFF (O) position.

Caution Before proceeding to the next step, verify that the source DC circuit breaker servicing the source DC power cables you are attaching to the DC-input power supply is in the OFF position. As an additional check, measure the voltage across the DC power cable leads that you intend to connect to the power supply. The voltage reading should be zero.

Step 2 Loosen the knurled thumbscrew that secures the plastic safety cover to the faceplate of the power supply. Slide the plastic safety cover to the right and upward until it can be removed from the knurled thumbscrew and the two standoffs in the power supply faceplate. Set the cover aside temporarily.

Step 3 Attach the source DC power cables to the power supply terminals in the following order:

(a) Ground

(b) + (positive)

(c) – (negative)

Note This order of connection of source DC power to the power supply terminals must be strictly observed.

Note The color coding scheme used for the source DC power cables for the DC-input power supply depends on the scheme used for the site DC power source. Typically, green or green/yellow is used for earth ground, red is used for positive (+), and black is used for negative (–). Make certain that you properly map the color coding scheme used at the site for the DC power source to the proper terminals on the DC-input power supply faceplate.

Step 4 Remove the loosely mounted nuts and locking washers from the earth ground terminals on the power supply faceplate; place the grounding cable over the ground terminals; secure the cable in place on the terminals with the supplied nuts and locking washers (see Figure 3-20a); tighten the nuts with a 10-mm nut driver or 1/4-inch socket wrench. Dress the cable up to the right and away from the power supply faceplate.

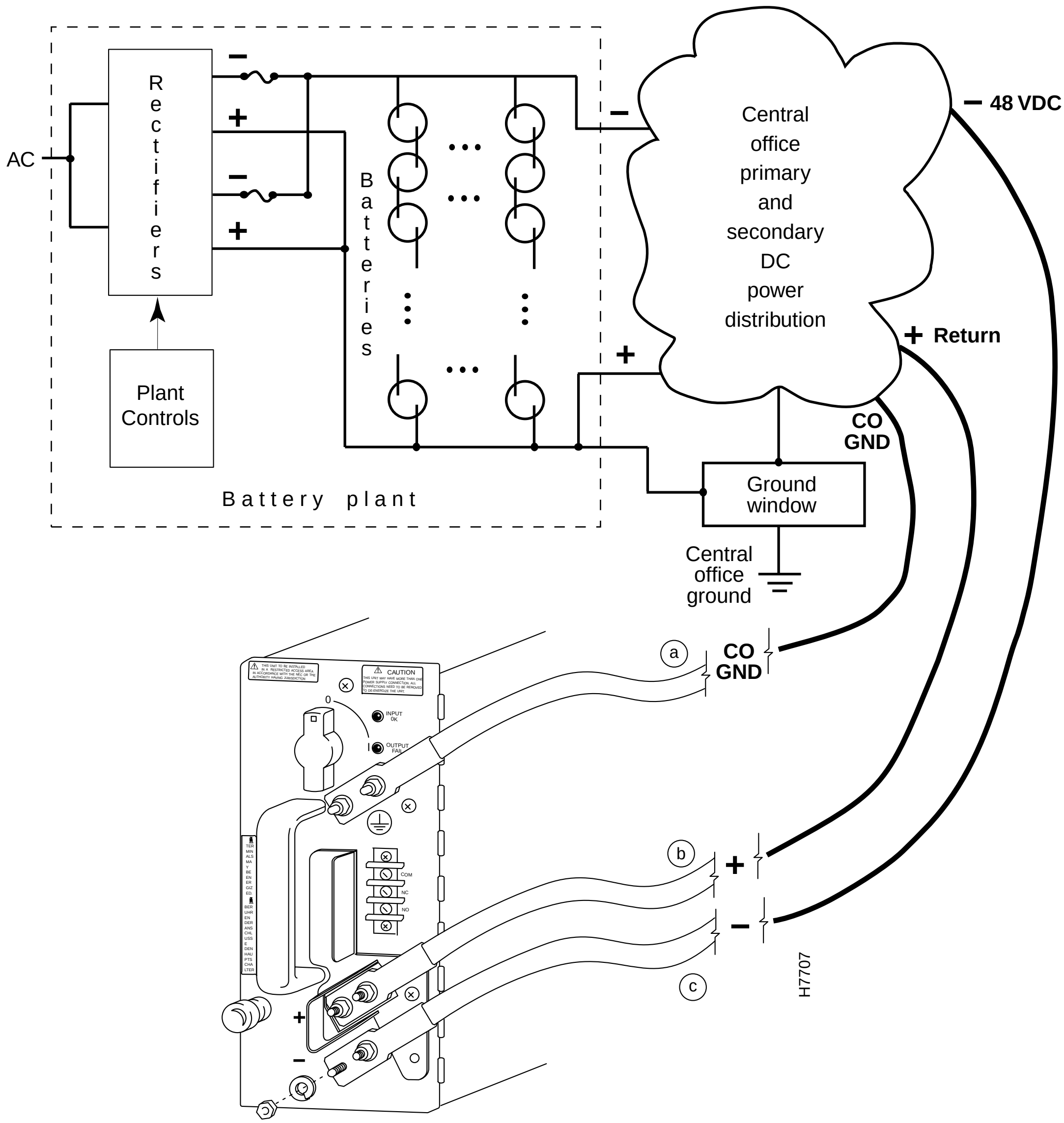
Caution Do not overtighten the nuts; a firm tightening only is recommended.

Step 5 Repeat the procedure outlined in Step 4 to connect the proper power cable to the + (positive) terminals on the power supply faceplate (see Figure 3-20b).

Step 6 Repeat the procedure outlined in Step 4 to connect the proper power cable to the – (negative) terminals on the power supply faceplate (see Figure 3-20c).

Note When securing the earth ground, positive (+), and negative (–) power cables to the power supply terminals, leave a small service loop in the earth ground cable. Doing so helps to ensure that the grounding cable will be the last one to be stressed or disconnected from the power supply if excessive strain is placed on the DC power cables.

Figure 3-20 Connecting Source DC Power Cables to a DC-Input Power Supply



Step 7 If you intend to attach an external alarm monitoring facility to the circuit breaker alarm terminal block on the power supply, do so at this time. For an illustration of how the leads from the alarm monitoring facility are connected to the alarm terminal block, refer to Figure 7-9 in the section entitled “Adding a DC-Input Power Supply” in Chapter 7.

The section in Chapter 1 entitled “Circuit Breaker Alarm Terminal Block” describes the alarm monitoring facility in greater detail. This facility provides an overt (visible or audible) indication that an overcurrent (fault) condition has occurred in the DC-input power supply.

Step 8 Verify that the source DC cables from the source DC circuit breaker to the power supply terminals are properly installed and that the locking washers and nuts are securely fastened to the terminals.

Step 9 Reinstall the plastic safety cover by placing it over the two standoffs and the knurled thumbscrew on the power supply faceplate, sliding the cover to the left and downward until it is seated, and hand tightening the knurled thumbscrew.

Step 10 Repeat the procedure in Step 1 through Step 8 to connect source DC power to the second (redundant) DC-input power supply, if one is present.

Caution At this time, *do not* turn the rotary power switch to the ON (|) position for either a single or a redundant DC-input power supply.

Step 11 Turn on the source DC circuit breaker that services the DC-input power supply(ies).

You are now ready to start up your Cisco 12008, as described in the following section.

Starting the Cisco 12008

This section presents the procedures for starting up your Cisco 12008. It is assumed that you have completed all essential site preparation and installation tasks, including the connection of network interface cables to line cards and the connection of source power cables to the power supply(ies).

To start up your Cisco 12008, perform the following steps:

Step 1 Verify that the following conditions are satisfied:

- Each line card is fully seated and its captive installation screws are tightened.
- The RP is fully seated and its captive installation screws are tightened.
- Each CSC, including the second (redundant) unit, if one is present, is fully seated in its dedicated slot in the middle of the upper card cage, and its captive installation screws are tightened.
- A vertical cable-management bracket is attached to each installed line card and the bracket's captive installation screws are tightened.
- All network interface cables are connected properly to line card ports and routed appropriately through the vertical cable-management brackets.
- The console interface cable is properly connected to the console port on the RP faceplate, and the installation screws on the connector are tightened.
- The source AC power cable is properly connected to the AC receptacle on the AC-input power supply and secured in place with the attached spring clip; likewise, verify the connections for the optional (redundant) AC-input power supply, if one is present.
- The source DC power cable leads are properly connected to the terminals on the power supply, and the protective plastic cover is in place over the power supply terminals; similarly, verify that these conditions are satisfied for the optional (redundant) AC-input power supply, if one is present.
- The main source power circuit breakers for the site are on.
- The console terminal is on.
- A Flash memory card containing the default Cisco IOS software is installed in PCMCIA slot 0 on the RP faceplate.

Step 2 Turn the rotary power switch on the power supply(ies) to the ON (|) position and observe the status of the LEDs on the power supply faceplate.

- For the AC-input power supply(ies), the green AC INPUT OK LED should go on.

- For the DC-input power supply(ies), the green INPUT OK LED should go on.

Step 3 Listen for the fans in the card cage fan tray and the power supply fan tray to power up. You should hear the fans come up to normal rotational speed in about 2 seconds.

In a noisy environment, you can check fan operation by placing your hand in front of the air filter assembly and the power supply fan tray to determine if air is being drawn into the interior of the router. Alternatively, you can place your hand at the top rear of the router to determine if air is being exhausted from the vents in the rear panel of the router enclosure.

This completes the initial installation procedures for the Cisco 12008. You can now proceed with the basic router configuration tasks, as presented in Chapter 4, “Observing System Startup and Performing a Basic Configuration.”

CHAPTER 4

Observing System Startup and Performing a Basic Configuration

This chapter describes the initial system startup process and provides procedures for performing a basic configuration for your Cisco 12008.

This chapter contains the following sections:

- Sources of Cisco IOS Software
- Checking Conditions Prior to System Startup
- Starting the System and Observing Initial Conditions
- Configuring the Cisco 12008
- Using the Setup Facility or the Setup Command
- Using the Global Configuration Mode
- Verifying the Running Configuration Settings
- Saving the Running Configuration Settings to NVRAM
- Reviewing the Running Configuration Settings
- Performing Other Configuration Tasks
- Configuring the Software Configuration Register
- Recovering a Lost Password
- Using Flash Memory Cards in the RP
- What to Do Next?
- If You Need More Configuration Information

This chapter will help you to

- Configure your router so that it can access the network
- Enable other hosts in the network to remotely access your system by means of a Telnet connection

Detailed configuration procedures for all of the line cards and network interfaces that you can install in your Cisco 12008 are beyond the scope of this document. Such information can be found in the configuration publications listed in the later section entitled “If You Need More Configuration Information.” In particular, for the Cisco 12000 series line card(s), you can refer to the configuration note(s) that shipped with your system.

Sources of Cisco IOS Software

A default Cisco IOS software image for your Cisco 12008 is available through any one of the following internal/external sources:

- Onboard Flash memory single inline memory module (SIMM) on the Route Processor (RP)—The latest Cisco IOS software image is pre-loaded into the Flash memory SIMM at the factory prior to router shipment. The Flash memory SIMM is also referred to as nonvolatile random access memory (NVRAM). This type of memory retains its contents when system power is turned off.
- Flash memory card—A Flash memory card inserted in a Personal Computer Memory Card Industry Association (PCMCIA) slot on the RP can serve as an external storage medium for a default Cisco IOS software image.
- TFTP server—A Trivial File Transfer Protocol (TFTP) server in the network can also function as an external source of a default Cisco IOS software image. A valid Cisco IOS software image can be downloaded from such a remote host by means of a Telnet connection.

Checking Conditions Prior to System Startup

Before attempting to start up your system, verify that the following conditions exist:

- All line cards in the upper card cage are fully inserted into their slots; all captive installation screws on the line cards are tightened.
- All clock and scheduler cards (CSCs) in the upper card cage are fully inserted.
- All switch fabric cards (SFCs) in the lower card cage are fully inserted.
- All interface cables are securely attached; where appropriate, adequate cable strain relief exists.
- Source power for the power supply(ies) is properly connected.
- The console terminal is connected to the console port on the RP.
- The console is configured for the appropriate communications parameters and turned on. (In order for you to perform the initial configuration of a Cisco 12008, you must have a console terminal connected to the console port on the RP.)
- The Flash memory card that shipped with your system is inserted in PCMCIA slot 0 on the RP.

Note By default, a Flash memory card containing a valid Cisco IOS software image is inserted in PCMCIA slot 0 prior to shipment. Also, by default, the software configuration register is set to 0x0102, causing the system to boot automatically from the Cisco IOS software image stored on the Flash memory card.

After verifying the above conditions, proceed to the next section to start up your Cisco 12008.

Starting the System and Observing Initial Conditions

This section describes the initial system startup processes and procedures.

To start up your Cisco 12008, perform the following steps:

Step 1 Apply power to each installed power supply by turning its rotary power switch fully clockwise to the ON (|) position.

As power is applied to the AC-input power supply(ies), both the green AC INPUT OK LED and the red OUTPUT FAIL LEDs go on momentarily. Refer to Figure 1-6 in Chapter 1 for the location of these LEDs on the AC-input power supply faceplate. Once system power stabilizes, the red OUTPUT FAIL LED should go off and remain so; the green AC INPUT OK LED, however, should remain on, indicating that normal power conditions exist in the router.

As power is applied to the DC-input power supply(ies), both the green INPUT OK LED and the red OUTPUT FAIL LEDs go on briefly. Refer to Figure 1-7 in Chapter 1 for the location of these LEDs on the DC-input power supply faceplate. Once system power stabilizes, the red OUTPUT FAIL LED should go off and remain so; the green INPUT OK LED, however, should remain on, indicating that normal power conditions exist in the router.

Step 2 Listen for the card cage fan tray and the power supply fan tray to power up; the fans in each fan tray should come up to full rotational speed in about 2 seconds.

The fans in both fan trays have two speeds - maximum and minimum. At initial application of system power, the fans run at maximum speed for a time until the system stabilizes. Then the fans revert to minimum speed, remaining in this state until an overtemperature condition or a card cage or power supply fan failure is detected by the router’s MBus facility. Either type of error condition causes the fans in both fan trays to run at maximum speed.

In a noisy environment, the fan trays might be difficult to hear. In this case, you can place your hand behind the exhaust vents at the top rear of the router enclosure to determine if air is being expelled from the router.

Step 3 During the RP boot process, observe the two, 4-digit alphanumeric LEDs at the bottom of the RP faceplate (see Figure 4-1). Table 4-1 shows representative system messages that appear in the RP LEDs.

Figure 4-1 RP Alphanumeric LEDs (Partial Faceplate View)

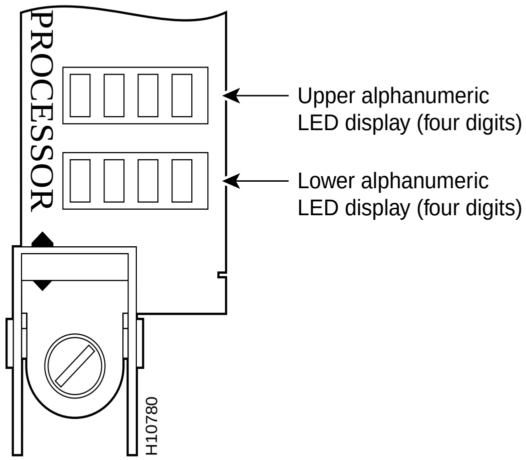


Table 4-1 Typical Contents of the RP Alphanumeric LEDs

LED Display	Meaning	Source
MROM *nnnn*	The MBus microcode begins to execute; *nnnn* is the microcode version number. For example, microcode version 1.17 would display as *0117*.[1] This display might not be visible, since it occurs briefly.	MBus controller
LMEM TEST	Low memory on the RP is being tested.	RP rommon
MEM INIT	The size of main memory on the RP is being discovered.	RP rommon
RP RDY	The system is operational and ready to execute basic IOS commands at the ROM monitor prompt (`rommon>`).	RP rommon
RP UP	A valid Cisco IOS image is running.	RP IOS
MSTR RP	The RP is enabled and recognized as the system master. A valid Cisco IOS image is running.	RP IOS

1. The version of MBus microcode running on your system might be different.

Step 4 During the line card boot process, which occurs immediately following that of the RP, observe the alphanumeric LEDs on each line card.

The alphanumeric LEDs on a line card are also located at the bottom of the line card faceplate (see Figure 4-2).

Figure 4-2 Line Card Alphanumeric Displays (Partial View Shown)

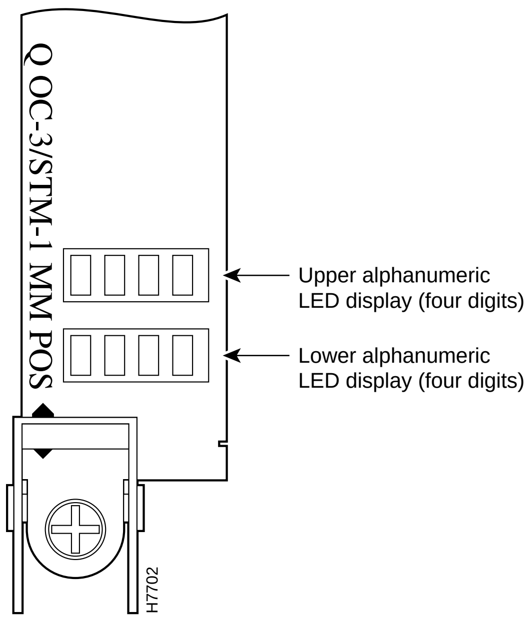


Table 4-2 shows typical contents of these line card alphanumeric LEDs. The LED display sequence shown in this table might occur too quickly to be seen; this sequence is provided to show the order of initialization and how the line cards function at startup.

Table 4-2 Typical Contents of the Line Card Alphanumeric LEDs

Line Card LED Display	Meaning	Source
MROM *nnnn*	The MBus microcode begins to execute; nnnn is the microcode version number. For example, microcode version 1.17 would display as 0117.[1] This display might not be visible, since it occurs briefly.	MBus controller
LMEM TEST	Low memory on the line card is being tested.	LC rommon
MEM INIT	The size of main memory on the line card is being discovered.	LC rommon
ROMI GET	The ROM image is being loaded into line card memory.	RP IOS
FABL WAIT	The line card is waiting for the loading of the fabric downloader.[2]	RP IOS
FABL DNLD	The fabric downloader is being loaded into line card memory.	RP IOS
FABL STRT	The fabric downloader is being launched.	RP IOS
FABL RUN	The fabric downloader has been launched and is running.	RP IOS
IOS DNLD	The Cisco IOS software is being downloaded into line card memory.	RP IOS
IOS STRT	The Cisco IOS software is being launched.	RP IOS
IOS UP	The Cisco IOS software is running.	RP IOS
IOS RUN	The line card is enabled and ready for use.	RP IOS

1. The version of MBus microcode running on your system might be different.
2. The fabric downloader loads the Cisco IOS software image onto the line card.

Note If a Flash memory card containing a valid Cisco IOS software image is inserted in PCMCIA slot 0 and the software configuration register is set to 0x0102 (the factory default setting), the system automatically boots using this image. The system then enters the setup facility, prompting you to perform a basic system configuration by means of an interactive script (see Step 9). Otherwise, the system remains at the ROM monitor prompt (`rommon>`), enabling you to enter configuration commands at the console terminal. In this case, proceed with Step 5.

Step 5 If the ROM monitor prompt (`rommon>`) appears, you must boot a Cisco IOS software image manually by issuing the **boot** command. The various forms of the **boot** command are described briefly below:

- **boot**—This form of the **boot** command (*without an argument*) boots the default Cisco IOS software image present in the onboard Flash memory SIMM. This image is pre-loaded into the SIMM at the factory prior to router shipment.

Caution To prevent problems, issue the **boot flash** command with care. Ensure that the Flash memory card in PCMCIA slot 0 contains a valid Cisco IOS image; otherwise, you could instruct the system to boot other than a valid image from the Flash memory card. To examine the contents of a Flash memory card, issue a **directory slot0:** command.

- **boot flash**—This form of the **boot** command does not specify a particular PCMCIA slot. Therefore, the system assumes by default that the Flash memory card is inserted in slot 0; accordingly, the system boots the first file found in the Flash memory card in slot 0.
- **boot slot0:** *filename*—This form of the **boot** command boots the specified file from the Flash memory card in PCMCIA slot 0.
- **boot slot1:** *filename*—This form of the **boot** command boots the specified file from the Flash memory card in PCMCIA slot 1.
- **boot** *filename* [*host*]—This form of the **boot** command boots the specified file from a host TFTP server in the network.

Step 6 To locate a desired Cisco IOS software image for manually booting the router from the ROM monitor prompt (`rommon>`), first determine the contents of the onboard Flash memory SIMM (NVRAM) on the RP by issuing the **directory** command:

```
rommon 1> dir bootflash:
   File size                  Checksum      File name
   3277967 bytes (0x32048f)   0x6b331e30    gsr-p-mz.112-9.GS4
rommon 2>
```

If the onboard Flash memory SIMM contains the desired Cisco IOS boot image, proceed to Step 8. Otherwise, continue with Step 7.

Step 7 If a Flash memory card is presently inserted in PCMCIA slot 0 or slot 1 (or both), determine the contents of the card(s) by issuing the appropriate form of the following command:

```
rommon 2> dir slot0: | slot1:
   File size                  Checksum      File name
   3054276 bytes (0x2e9ac4) 0x97788495      gsr-p-mz.112-9.GS4
rommon 3>
```

If you find the desired Cisco IOS boot image in a Flash memory card, proceed with Step 8.

Step 8 After locating the desired Cisco IOS software image for manually booting the router, select the appropriate form of the **boot** command from the following list and issue it at the ROM monitor prompt:

```
rommon 3> boot bootflash:gsr-p-mz.112-9.GS4
```

This command boots the specified file from the onboard Flash memory SIMM (NVRAM) on the RP.

```
rommon 3> boot slot0:gsr-p-mz.112-9.GS4
```

This command boots the specified file from the Flash memory card in PCMCIA slot 0.

```
rommon 3> boot slot1:gsr-p-mz.112-9.GS4
```

This command boots the specified file from the Flash memory card in PCMCIA slot 1.

```
rommon 3> boot tftp:gsr-p-mz.112-9.GS4 <ip-address>
```

This command boots the specified file from the host TFTP boot server in the network.

Note If you have not changed the contents of the software configuration register, the factory default setting of 0x0102 in this register causes the system to boot Cisco IOS software from a Flash memory card inserted in PCMCIA slot 0 the next time you boot the router.

After manually booting the router using the **boot** command, as outlined above, continue with the following steps.

Step 9 As the system boots the Cisco IOS software image, the console displays a system banner and script similar to the following:

```
Cisco Internetwork Operating System Software
IOS (tm) GS Software (GSR-P-MZ), Released Version 11.2(8)GS
Copyright (c) 1986-1997 by Cisco Systems, Inc.
Compiled Sat 10-May-97 06:02a
```

Observe the system startup banner. When you first start up an unconfigured system, it automatically enters the setup facility. The setup facility detects the network interfaces installed in the router and prompts you for configuration information for each one.

For example, after the system displays the system banner and hardware configuration, the following system configuration script appears:

```
         --- System Configuration Dialog ---

At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.

Continue with configuration dialog? [yes/no]:
```

The system asks you if you want to continue with the configuration dialog. If you answer **yes**, the system proceeds with the interactive script for the setup facility. If you answer **no**, the system exits from the setup facility. In this case, you must issue configuration commands at the console terminal to configure the system and network interface parameters.

You need not configure the network interfaces immediately; however, you cannot connect to a network until you configure the interfaces for operation in your networking environment. To do this, refer to the following section entitled "Configuring the Cisco 12008."

Configuring the Cisco 12008

The information in this section applies only if the system does not boot automatically on startup from a specified default Cisco IOS software image.

The Cisco 12008 is administered by means of a command language interpreter called the *EXEC*. You must boot the router and log in to the system before you can issue commands to the EXEC.

For security purposes in issuing commands, the EXEC has two levels of access:

- User EXEC mode—On startup of the Cisco IOS software, the system presents the user EXEC mode prompt:

  ```
  Router>
  ```

- Privileged EXEC mode—If you enter an enable secret password (which must first have been saved in memory) at the user EXEC mode prompt, the system changes to the privileged EXEC mode prompt (`Router#`), as indicated below:

  ```
  Router> enable
  password: xxxxxxxxx
  Router#
  ```

For information about using passwords, refer to Step 5 and Step 6 in the section entitled "Configuring Global Parameters."

You can perform a basic configuration for your Cisco 12008 using either of the following methods:

- Method 1—Using the setup facility or the **setup** command.

  At initial startup of a completely unconfigured router, the system automatically defaults to the setup facility, which enables you to begin manually configuring your router. The setup facility presents a structured, interactive script that guides you through the process of manually configuring your router.

  You can invoke the setup facility at any time by issuing the **setup** command at the privileged EXEC mode prompt (`Router#`), thus making available to you the same configuration script that appears automatically at initial startup of an unconfigured router.

  You can issue the **setup** command at any time; the premise for doing so is that you want to alter some previously entered configuration information.

  The setup facility is described in the section entitled "Using the Setup Facility or the Setup Command."

- Method 2—Using the global configuration mode.

  If you prefer not to use the interactive script of the setup facility to configure your router, you can still configure your router manually using the global configuration mode. This facility, which requires you to issue configuration commands on a line-by-line basis at the console without being prompted by a configuration script, is described in the section entitled "Using the Global Configuration Mode."

You can use whichever method suits your operating style and your knowledge of network configuration requirements. The advantage in using the setup facility is that the system guides you through the configuration process through an interactive script that minimizes the likelihood of errors.

To configure the Cisco 12008 to operate in your networking environment, you will need to obtain the correct network addresses from your system administrator or your network plan.

Using the Setup Facility or the Setup Command

You must consider the following types of parameters during the initial manual configuration of your router:

- Global (system-wide) parameters
- Network interface (line card) parameters

As noted earlier, you can establish the above parameters using the setup facility (as presented to you automatically at initial system startup), or you can issue the **setup** command at any time at the privileged EXEC prompt (`Router#`) to activate the setup facility.

The only observable difference between the configuration script displayed when you use the setup facility automatically on startup and that displayed when you issue the **setup** command is that the latter displays any existing (previously entered) system configuration defaults within square brackets [ ].

For example, during the configuration of a POS interface by means of the setup facility at startup (assuming that the interface has *not* previously been configured), you will see a display in the following form as you proceed through the script and respond to queries:

```
Configuring interface POS4/0:
  Is this interface in use?: yes
  Configure IP on this interface?: yes
```

No default or current parameters are enclosed within square brackets [ ] in the configuration dialog in this instance.

Conversely, when you issue the **setup** command at the privileged EXEC mode prompt (assuming that the POS interface *has been* previously configured and you are being queried by the system for changes), you will see a display in the following form:

```
Configuring interface POS4/0:
  Is this interface in use?[yes]: yes
  Configure IP on this interface?[yes]: yes
```

The default or current parameters applicable to the interface *are* enclosed within square brackets [ ].

Proceed to the following sections to configure the global and line card interface parameters for your system.

Configuring Global Parameters

When you first enter the setup facility or issue the **setup** command, you are queried by the system to configure global parameters for your router.

To boot the system and establish global configuration parameters, perform the following steps:

Step 1 Connect a console terminal to the console port on the RP.

Step 2 Boot the system to display the user EXEC prompt (`Router>`).

After about 30 seconds, the following display appears on the console, indicating that you have successfully booted the system:

```
System Bootstrap, Version 11.2(8)GS [biff 571], RELEASED SOFTWARE
Copyright (c) 1994-1997 by Cisco Systems, Inc.

Restricted Rights Legend

Use, duplication, or disclosure by the Government is
subject to restrictions as set forth in subparagraph
(c) of the Commercial Computer Software - Restricted
Rights clause at FAR sec. 52.227-19 and subparagraph
(c) (1) (ii) of the Rights in Technical Data and Computer
Software clause at DFARS sec. 252.227-7013.

           Cisco Systems, Inc.
           170 West Tasman Drive
           San Jose, California 95134-1706

Cisco Internetwork Operating System Software
IOS (tm) GS Software (GSR-P-MZ), Released Version 11.2(8)GS [biff-
bfr_112]
Copyright (c) 1986-1997 by Cisco Systems, Inc.
Compiled Mon 25-Aug-97 20:13 by biff
Image text-base: 0x60010900, data-base: 0x604FE000

Cisco 12008/GRP (R5000) processor (revision 0x00) with 65536K
bytes of memory.
Processor board ID 00000000
R5000 processor, Implementation 35, Revision 2.1 (512KB Level 2
Cache)
Last reset from power-on
1 clock scheduler card(s)
3 switch fabric card(s)
```

```
2 four-port OC3 POS controllers (8 POS).
5 OC12 POS controllers (5 POS).
1 Ethernet/IEEE 802.3 interface(s)
13 Packet over Sonet network interface(s)
507K bytes of non-volatile configuration memory.

20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
Notice: NVRAM invalid, possibly due to write erase.
```

Note The first two sections of the above configuration script (containing the banner screen and the installed hardware listing) appear only at initial system startup. On subsequent uses of the **setup** command facility, the setup script begins with the following system configuration dialog.

```
         --- System Configuration Dialog ---

At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.

Continue with configuration dialog? [yes/no]: yes
```

Enter **yes** when queried if you want to continue with the configuration dialog.

Note The examples in this section represent a continuation of the console display for the setup facility or the **setup** command.

Step 3 Enter **yes** when asked if you wish to enter the initial configuration dialog and if you wish to see the current interface summary:

```
Would you like to enter the initial configuration dialog? [yes]:
yes

First, would you like to see the current interface summary? [yes]:
yes
```

Pressing **Return** in either case accepts the default response [yes].

The following sample display results from a **yes** response to the current interface summary query that is entered while you are using the setup facility. The display shows that no interfaces have been configured:

```
Interface   IP-Address      OK? Method Status                Protocol
Ethernet0   unassigned      YES unset  administratively down down
POS3/0      unassigned      YES unset  administratively down down
POS3/1      unassigned      YES unset  administratively down down
POS3/2      unassigned      YES unset  administratively down down
POS3/3      unassigned      YES unset  administratively down down
ATM4/0      unassigned      YES unset  administratively down down

.
.
.
```

The following sample display results from a **yes** response to the current interface summary query that is entered while you are using the **setup** command. The display shows that some interfaces have already been configured.

```
Interface   IP-Address      OK? Method Status                Protocol
Ethernet0   3.3.1.1         YES NVRAM  up                    up
POS3/0      2.1.1.1         YES NVRAM  up                    up
POS3/1      2.1.1.2         YES NVRAM  up                    up
POS3/2      2.1.1.3         YES NVRAM  up                    up
POS3/3      2.1.1.4         YES NVRAM  up                    up
ATM4/0      1.1.1.2         YES NVRAM  up                    up

.
.
.
```

Step 4 Select the protocols that you intend to support for your network interfaces.

For IP–only installations, you can accept the default values for most of the questions.

A typical minimum configuration procedure using IP follows and continues through Step 8:

```
Configuring global parameters:

Enter host name [Router]: Router
```

Step 5 Enter the *enable secret* password when prompted to do so:

```
The enable secret is a one-way cryptographic secret used
instead of the enable password when it exists.

Enter enable secret [<Use current secret>]: barney
```

For future use, make a note of this password.

Step 6 Enter the *enable password* when prompted to do so:

```
The enable password is used when there is no enable secret
and when using older software and some boot images.

 Enter enable password: wilma
```

For future use, make a note of this password also.

The commands available at the user EXEC level are a subset of those available at the privileged EXEC level. Because many privileged EXEC commands are used to establish system parameters, you should password-protect these commands to prevent their unauthorized use.

The enable secret password functionality is available for all Cisco 12000 series Gigabit Switch Routers. You must enter the correct password to gain access to privileged-level commands. When you are running from the ROM monitor (`rommon>`), the enable password can be used, depending on your boot ROM level.

For maximum security, the *enable secret* and the *enable password* should be different. If you use the same password for both the enable secret and enable functions during the setup process, the system accepts it but issues a warning indicating that you should enter a different password.

An enable secret password can contain from 1 to 25 uppercase and lowercase alphanumeric characters; an enable password can contain any number of uppercase and lowercase alphanumeric characters.

In either case, you cannot use a number as the first character. Spaces, however, are valid password characters. For example, “two words” is a valid password. Leading spaces are ignored, but trailing spaces are recognized.

Step 7 Enter the virtual terminal password when prompted to do so:

```
Enter virtual terminal password: bambam
```

For future use, make a note of this password.

Step 8 In most cases, you will use IP routing as the network layer protocol. If you specify IP, you must also specify an interior routing protocol.

Enter **yes** (the default) or press **Return** to configure IP; do likewise to select the Interior Gateway Routing Protocol (IGRP) as the interior routing protocol. Specify the IGRP autonomous system number, as follows:

```
Configure IP? [yes]: yes
   Configure IGRP routing? [yes]: yes
     Your IGRP autonomous system number [1]: 199
```

Note For complete information about IP routing and autonomous system numbers, refer to the appropriate software configuration publications listed in the section entitled “If You Need More Configuration Information.” The Ethernet interface does not support external routing functions.

Step 9 Enter **yes** or **no** to the following query to accept or refuse Simple Network Management Protocol (SNMP) management:

```
Configure SNMP Network Management? [yes]:
  Community string [public]:
```

Note SNMP is the most widely supported standard for managing networks. SNMP provides a means to access and set configuration and run-time parameters and to monitor and control network elements for routers and communication servers. For more information about SNMP, refer to the appropriate software configuration publications listed in the section entitled “If You Need More Configuration Information.”

Step 10 Enter **yes** or **no** to the following query to accept or refuse Connectionless Network Service (CLNS) management:

```
  Configure CLNS? [no]: yes
    CLNS router tag [area_1]:
    CLNS domain [49]:
    CLNS area [0001]:
CLNS station id [0027.25E9.B640]:
```

Note CLNS is an Open System Interconnection (OSI) layer service that does not require a circuit to be established before transmitting data. For more complete information about CLNS, refer to the appropriate software configuration publications listed in the section entitled “If You Need More Configuration Information.”

On completion of this procedure, you have successfully established the router’s global configuration parameters.

Sample Display of Global Parameters

The following sample display lists the global parameters that you entered in Step 3 through Step 10 in the preceding section.

The display indicates the order in which the parameters and their defaults appear on your console terminal.

```
Configuring global parameters:

Enter host name: Router
Enter enable secret: barney
Enter enable password: wilma
Enter virtual terminal password: bambam
Configure IP?: yes
    Configure IGRP routing?: yes
      Your IGRP autonomous system number [1]: 199
Configure SNMP Network Management?: yes
    Community string [public]:
Configure CLNS? [no]: yes
    CLNS router tag [area_1]:
    CLNS domain [49]:
    CLNS area [0001]:
    CLNS station id [0027.25E9.B640]:
```

Configuring Network Interfaces

This section presents procedures for configuring the network interfaces for the RP and the installed line cards through use of the setup facility or the **setup** command. Once configured, the RP and line cards can communicate with external networks.

To configure the interface parameters for the RP and installed line cards, you need the following information:

- Interface network addresses
- Subnet masks
- Protocols to be configured

To obtain this information, consult your network administrator.

For additional interface configuration information for the RP and each of the line cards installed in your Cisco 12008, refer to the configuration note that shipped with each card.

Note The sample configuration dialog in this section continues the script displayed when you used the setup facility or the **setup** command in establishing the system's global parameters (see the section entitled "Configuring Global Parameters"). The output shown in this section is only an example; your configuration dialog might be different, depending on how you configure your router.

To configure the Ethernet interfaces on the RP and the network interfaces for the installed line cards, perform the following steps:

Step 1 Configure the RP Ethernet interfaces.

The RJ-45 and MII receptacles on the faceplate of the GRP are IEEE 802.3u- compliant interfaces. The RJ-45 receptacles on the faceplate of the PRP are IEEE 802.3u-compliant interfaces. These IEEE interfaces provide connectivity to Ethernet networks.

In the following example, the system is being configured for an Ethernet interface that will use the IP network layer protocol. (The Ethernet interface does not support external routing functions.)

In the following configuration dialog, respond to the queries according to your own configuration requirements. Use your IP address and subnet mask in responding to the setup prompts.

```
Configuring interface Ethernet0:
  Is this interface in use?: yes
  Configure IP on this interface?: yes
    IP address for this interface: 3.3.1.1
    Number of bits in subnet field: 8
    Class A network is 3.0.0.0, 8 subnet bits; mask is 255.255.0.0
  Configure CLNS on this interface?: yes
```

Step 2 Configure the line card interfaces.

The Packet-Over-SONET (POS) line card interfaces enable connections to be made to external OC-3/STM-1 or OC-12/STM-4 networks.

In the following sample configuration dialog for a Quad OC-3c POS line card, respond to the queries according to your configuration requirements. Use your IP address and subnet mask in responding to the setup prompts.

Also, consider Step 3 below, which shows this same Quad OC-3c POS line card interface being configured for IP unnumbered; perform whichever step is appropriate to your configuration requirements.

```
Configuring interface POS4/0:
  Is this interface in use?: yes
  Configure IP on this interface?: yes
  Configure IP unnumbered on this interface?: no
    IP address for this interface: 2.1.1.1
    Number of bits in subnet field: 0
    Class A network is 2.0.0.0, 0 subnet bits; mask is 255.0.0.0
  Configure CLNS on this interface?: yes
```

Note For POS interfaces, the cyclic redundancy check (CRC) is 32-bits by default.

Note For POS interfaces, the encapsulation protocol is HDLC by default.

For more complete POS interface configuration information, refer to the documents entitled *Quad OC-3c/STM-1c Packet-Over-SONET Line Card Installation and Configuration* (document number 78-4333-02) and *OC-12c/STM-4c Packet-Over-SONET Line Card Installation and Configuration* (document number 78-4341-02). These documents accompanied the shipment of your Quad OC-3c/STM-1c and OC-12c/STM-4c POS line cards, respectively.

Step 3 Configure the POS line card interface(s).

In the following sample configuration dialog, a Quad OC-3c POS line card interface is being configured to use IP unnumbered:

```
Configuring interface POS4/0:
  Is this interface in use?: yes
  Configure IP on this interface?: yes
  Configure IP unnumbered on this interface?: yes
    Assign to which interface: ethernet0
  Configure CLNS on this interface?: yes
```

Repeat Step 2 or Step 3, as required, to individually configure each port on every Quad OC-3c POS line card installed in your system.

If you have an ATM line card installed in your router, proceed with Step 4; otherwise, skip to Step 5.

Step 4 Configure the ATM line card interface(s).

Asynchronous Transfer Mode (ATM) interfaces enable connections to external OC-12/STM-4 networks.

In the following example, an ATM line card is being configured to use IP. Respond to the configuration dialog, as appropriate for your configuration. Use your address and subnet mask for the setup prompts.

```
Configuring interface parameters:

Configuring interface ATM1/0:
  Is this interface in use?: yes
  Configure IP on this interface?: yes
    IP address for this interface: 1.1.1.2
    Number of bits in subnet field: 0
    Class A network is 1.0.0.0, 0 subnet bits; mask is 255.0.0.0
```

Note You might have to establish additional configuration parameters for the installed ATM line cards if you want to fully utilize them. The new parameters would be used in such activities as the configuring of permanent virtual circuits (PVCs).

For more complete configuration information for ATM line cards, refer to the document entitled *OC-12c/STM-4c Asynchronous Transfer Mode Line Card Installation and Configuration* (document number 78-4344-02) that accompanied the shipment of your OC-12c/STM-4c ATM line card.

Repeat Step 4 for each installed ATM line card. To display and verify the ATM line card configuration parameters, proceed with Step 5.

Step 5 When you have completed entering the configuration information for all of the installed line cards, the following configuration query is displayed:

```
Use this configuration? [yes/no]:
```

At this point, you should visually verify all of the configuration parameters displayed on your console terminal.

Answer **yes** if you want to save the running configuration file to NVRAM and display the following additional output:

```
Use this configuration? [yes/no]: yes
[OK]
Use the enabled mode ‘configure’ command to modify this
configuration.
Press RETURN to get started!
```

After you press **Return**, the system reverts to the user EXEC prompt:

```
Router>
```

Answer **no** to the configuration query to return to the privileged EXEC mode prompt (`Router#`). You must reissue the **setup** command and enter the appropriate RP and line card configuration information.

On completion of this procedure, you have manually configured the global system parameters and the network interface parameters using the setup facility or the **setup** command. Your Ethernet, POS, and ATM interfaces are now available for limited use.

If you wish to modify the currently saved configuration information (after you complete the preceding procedure), issue the **setup** command at the privileged EXEC mode prompt (`Router#`) at any time.

To perform more complex configuration tasks, you can enter the **configure** command at the privileged EXEC mode prompt (`Router#`), which establishes the global configuration mode [`Router(config)#`]. This mode is described in the section entitled “Using the Global Configuration Mode.”

Checking the Software Version Number and the Installed Interfaces

To determine the current version of the Cisco IOS software running on your router, issue the **show version** command at the user EXEC prompt (`Router>`).

This command causes the Cisco IOS version number to be displayed, as well as other information, including the hardware installed in the system, the names and sources of system image files, and the contents of the software configuration register.

A typical sample display resulting from the issuance of the **show version** command follows:

```
Router>show version
Cisco Internetwork Operating System Software
IOS (tm) GS Software (GSR-P-MZ), Released Version 11.2(8)GS [biff-
bfr_112]
Copyright (c) 1986-1997 by Cisco Systems, Inc.
Compiled Mon 25-Aug-97 20:13 by biff
Image text-base: 0x60010900, data-base: 0x604FE000

ROM: System Bootstrap, Version 11.2(8)GS [biff-bfr_112], RELEASED
SOFTWARE
BOOTFLASH: GS Software (GSR-BOOT-M), Released Version 11.2(8)GS [biff-
bfr_112 1913]

Router uptime is 20 days, 12 hours, 16 minutes
System restarted by reload
System image file is “biff/gsr-p-mz”, booted via tftp from 1.1.1.254

Cisco 12008/GRP (R5000) processor (revision 0x00) with 65536K bytes of
memory.
Processor board ID 00000000
R5000 processor, Implementation 35, Revision 2.1 (512KB Level 2 Cache)
Last reset from power-on
1 clock scheduler card(s)
3 switch fabric card(s)
1 Single-port OC12c ATM controller (1 ATM).
1 four-port OC3 POS controller (4 POS).
1 Ethernet/IEEE 802.3 interface(s)
1 ATM network interface(s)
4 Packet over Sonet network interface(s)
507K bytes of non-volatile configuration memory.
```

```
20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x0102
```

Using the Global Configuration Mode

If you prefer not to use the interactive script of the setup facility, you can manually configure your router using the global configuration mode. The global configuration mode enables you to enter configuration commands on a line-by-line basis from the console terminal.

To configure your router using the configuration mode, perform the following steps:

Step 1 Connect a console terminal to the console port on the faceplate of the RP.

Step 2 When asked if you want to enter the initial dialog, answer **no.** This causes the router to enter the user EXEC mode. After a few seconds, the user EXEC mode prompt (`Router>`) appears:

```
Would you like to enter the initial dialog? [yes]: no
Router>
```

Step 3 At this prompt, enter the **enable** command to establish the privileged EXEC mode:

```
Router> enable
Router#
```

Note Configuration changes can be made only in the privileged EXEC mode.

Step 4 At the privileged EXEC mode prompt, enter the **config terminal** command to enter the global configuration mode:

```
Router# config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```

At the global configuration mode prompt, enter the **interface** *type slot/port* command to enter the interface configuration mode:

```
Router(config)# interface type slot/port
Router(config-if)#
```

This command accepts either POS or ATM as the *type* argument.

In either the global configuration mode or the interface configuration mode, you can change the router's configuration parameters.

To exit either mode, type **Ctrl-Z**.

Step 5 Save your configuration settings, as described in the section entitled "Saving the Running Configuration Settings to NVRAM."

Your router is now minimally configured and able to boot using the currently established configuration information.

To display a list of the configuration commands available to you, enter a question mark (**?**) at the global configuration mode prompt (`Router(config)#`) or press the **help** key.

Verifying the Running Configuration Settings

You may want to verify the running configuration settings or any changes made to the running configuration settings before they are saved. To do so, issue the **show running-config** command at the privileged EXEC mode prompt.

Typical output from this command is shown in the following sections for the following types of line cards:

- Quad OC-3c/STM-1c POS
- OC-12c/STM-4c POS
- OC-12c/STM-4c ATM

Example of Running Configuration Settings for Quad OC-3 POS Interface

The **show running-config** command typically displays output in the following form for a Quad OC-3c/STM-1c POS interface installed in slot 7:

```
Ohm#sh run
Building configuration...

Current configuration:
!
version 11.2
no service pad
no service udp-small-servers
no service tcp-small-servers
!
hostname Ohm
!
enable secret 5 $1$W6K5$W/p5Bq6IPLGJ/hS9VVP1g.
enable password lab

interface POS7/0
 ip address 11.1.1.1 255.255.255.0
 crc 32
 clock source internal
!
interface POS7/1
 no ip address
 no ip route-cache cef
 no ip route-cache
 shutdown
 crc 32
!
interface POS7/2
 no ip address
 no ip route-cache cef
 no ip route-cache
 shutdown
 crc 32
!
interface POS7/3
 no ip address
 no ip route-cache cef
 no ip route-cache
 shutdown
 crc 32
```

Example of Running Configuration Settings for OC-12 POS Interface

The **show running-config** command typically displays output in the following form for an OC-12 POS interface installed in slot 6:

```
Turing#sh run
Building configuration...

Current configuration:
!
version 11.2
no service pad
no service udp-small-servers
no service tcp-small-servers
!
hostname Turing

-----------!
enable password lab
!
no ip domain-lookup
ip host ray 172.27.136.253
ip host crusty 171.69.209.28
!

!
interface POS6/0
 ip address 12.1.1.1 255.255.255.0
 crc 32
!
```

Example of Running Configuration Settings for OC-12 ATM Interface

The **show running-config** command typically displays output in the following form for an OC-12 ATM interface installed in slot 6:

```
Turing#sh run
Building configuration...

Current configuration:
!
version 11.2
no service pad
no service udp-small-servers
```

```
no service tcp-small-servers
!
hostname Turing

-------------!
enable password lab
!
no ip domain-lookup
ip host ray 172.27.136.253
ip host crusty 171.69.209.28
!

!
interface POS6/0
 ip address 12.1.1.1 255.255.255.0
 crc 32
!
```

Saving the Running Configuration Settings to NVRAM

To save the running configuration settings to NVRAM, enter the following command at the privileged EXEC mode prompt (`Router#`):

```
Router# copy running-config startup-config
```

As an alternative, you can also use the following command to save the running configuration settings:

```
Router# write memory
```

Either command saves to NVRAM the configuration settings that you created while in the global configuration mode.

If you fail to take this step, your configuration settings will be lost the next time you reload the system.

Reviewing the Running Configuration Settings

To display the running configuration settings stored in NVRAM, issue the **show startup-config** command at the privileged EXEC mode prompt. This command displays output in the following form:

```
Router# show startup-config
Using 1133 out of 520184 bytes
!
version 11.2
no service udp-small-servers
no service tcp-small-servers
!
hostname Router
!
enable password wilma
ip cef distributed switch
ip host biff 3.3.3.254
!
interface Ethernet0
 ip address 3.3.1.1 255.255.0.0
 no ip mroute-cache
!
interface POS3/0
 ip address 2.1.1.1 255.0.0.0
 no keepalive
 crc 16
 no cdp enable
!
interface POS3/1
 ip address 2.1.1.2 255.0.0.0
 no keepalive
 crc 16
 no cdp enable
!
interface POS3/2
 ip address 2.1.1.3 255.0.0.0
 no keepalive
 crc 32
 no cdp enable
!
interface POS3/3
 ip address 2.1.1.4 255.0.0.0
 no keepalive
 crc 32
```

```
 no cdp enable
!
interface ATM4/0
 ip address 15.0.0.15 255.0.0.0 secondary
 ip address 1.1.1.2 255.0.0.0
 atm pvc 1 0 64 aal5snap
 atm pvc 2 0 72 aal5mux ip 155000 155000 1
 atm pvc 3 1 90 aal5snap 312000 312000 1
 atm pvc 4 0 108 aal5snap
 atm pvc 10 0 144 aal5mux ip 155000 155000 1
 atm pvc 11 1 91 aal5snap 310000 310000 1
 map-group atm1
!
no ip classless
ip route 2.5.4.254 255.255.255.255 Ethernet0
!
map-list atm1
 ip 1.1.1.1 atm-vc 1
 ip 1.1.1.3 atm-vc 2
 ip 1.1.1.4 atm-vc 4
 ip 15.0.0.1 atm-vc 3
 ip 15.0.0.5 atm-vc 10
 ip 15.0.0.6 atm-vc 11
no logging trap
!
!
line con 0
 exec-timeout 0 0
line aux 0
line vty 0 4
 password bambam
 login
!
end
```

Performing Other Configuration Tasks

This section presents procedures for performing the following additional configuration tasks:

- Configuring the Software Configuration Register
- Recovering a Lost Password
- Using Flash Memory Cards in the RP

Configuring the Software Configuration Register

The software configuration register is a 16-bit register in NVRAM that you use to define specific system parameters. You can set or change the contents of this register to accomplish the following tasks:

- Define boot sources for the default Cisco IOS software, assigning them in the following order of precedence:
  - — Flash memory card inserted in PCMCIA slot 0
  - — TFTP server in the network
  - — Flash memory SIMM (NVRAM) on the RP
  - — Boot image stored within the operating environment, which you access by means of an appropriate form of the **boot** command issued at the ROM monitor prompt (`rommon>`)
- Define a default boot filename.
- Enable or disable the Break function.
- Control broadcast addresses.
- Set the console terminal baud rate.
- Recover a lost password.

- Force an automatic boot using a boot image.

  When you first power on the router, a boot image called the RP ROM monitor is executed, resulting in the display of the ROM monitor prompt (`rommon>`). At this prompt, you have access to a limited set of commands that enable you to set values in the software configuration register and to perform a number of other tasks.

  The RP ROM monitor is loaded into the RP Flash ROM during board manufacture. You can use it to boot the system from local Flash memory devices; the RP ROM monitor software can be upgraded in the field, if necessary.

- Read **boot system** commands from the configuration file stored in NVRAM.

  Table 4-3 defines the bits in the software configuration register. The factory default value for the software configuration register is 0x0102. This value is a combination of the following: binary bit 8 = 0x0100 and binary bits 00 through 03 = 0x0002 (see Table 4-3).

Caution To avoid confusion, note that valid software configuration register values may be combinations of settings, rather than the individual settings listed in Table 4-3. For example, the factory default value 0x0102 for the software configuration register is actually a composite of settings in this register.

Table 4-3 Definition of Bits in the Software Configuration Register

Bit Number	Hexadecimal Value	Meaning/Function
00 through 03	0x0000 to 0x000F	Comprises the boot field for defining the source of a default Cisco IOS software image required to run the router (see Table 4-4).
06	0x0040	Causes system software to ignore the contents of NVRAM.
07	0x0080	The OEM[1] bit is enabled.
08	0x0100	The Break function is disabled.
09	0x0200	Use a secondary bootstrap.
10	0x0400	Internet Protocol (IP) broadcast with all zeros.

Table 4-3 Definition of Bits in the Software Configuration Register (Continued)

Bit Number	Hexadecimal Value	Meaning/Function
11 and 12	0x0800 to 0x1000	Defines the console baud rate (the default setting is 9600 baud).
13	0x2000	Boots the default Flash memory software if the network boot fails.
14	0x4000	IP broadcasts do not have network numbers.
15	0x8000	Enables diagnostic messages and ignores the contents of NVRAM.

1. OEM stands for original equipment manufacturer.

Table 4-4 specifies the content of the *boot field*, which defines a source for booting the default Cisco IOS software image required to run the router. The content of the boot field is specified as a binary number.

Table 4-4 Definition of Bits in Boot Field of Software Configuration Register

Boot Field Bits	Meaning
00	On power up, the system remains at the ROM monitor prompt (`rommon>`), awaiting a user command to boot the system manually.
01	On power up, the system automatically boots the first system image found in the onboard Flash memory single inline memory module (SIMM) on the RP.
02 to 0F	On power up, the system boots automatically from a default Cisco IOS software image stored on a TFTP server in the network. For this setting, it is assumed that the Ethernet port on the RP is configured and operational. A default Cisco IOS software image is typically kept on a Cisco "Help Desk" server in the network for ready access by anyone needing a boot image. This setting also enables boot system commands that override the default filename.

Boot Field Settings and the Use of the Boot Command

The four low-order bits of the software configuration register (bits 3, 2, 1, and 0) form a *boot field* that defines the source of a Cisco IOS software image for booting the router.

You can set or change the contents of the boot field by issuing the **config-register** command at the global configuration mode prompt [`Router(config)#`].

Note The factory default setting for the software configuration register (and RP spares) is 0x0102.

When the boot field is set to either 0 or 1 (0-0-0-0 or 0-0-0-1), the system ignores any boot instructions in the system configuration file and one of the following occurs, depending on the boot field setting:

- When the boot field is set to 0, you must boot the system manually by issuing the **boot** command at the ROM monitor prompt (`rommon>`). You can issue the **boot** command with or without arguments.

  If you issue the **boot** command *without* an argument (that is, without specifying a file or any other boot instructions), the system automatically boots using the default image in the Flash memory SIMM on the RP.

  If you issue the **boot** command *with* arguments (that is, by instructing the system to boot from a specific source), the following options are available to you:

  — You can instruct the system to boot from a specific Flash SIMM image (by issuing the **boot system flash *filename*** command), or you can instruct the system to boot from a specific image stored on a PCMCIA Flash memory card (by issuing the **boot <slot #:> <*imagename*>** command).

  — You can instruct the system to boot from a network TFTP server either by sending broadcast TFTP requests (by issuing a **boot system *filename*** command), or by sending a direct request to a specific network TFTP server (by issuing a **boot system *filename* ip-address** command).

- When the boot field is set to 1, the system automatically boots using the first image found in the onboard Flash SIMM on the RP.

If you set the boot field to any bit pattern other than 0 or 1, the router uses the software configuration register settings to compute a filename from which to boot a default system image stored on a network TFTP server.

To form this filename, the system starts with *cisco* and links the octal equivalent of the boot field value and the processor type in the following format:

cisco<bootfieldvalue>-<processorname>

This format, for example, would yield the following range of typical filenames:

cisco2-grp

.
.
.

cisco17-grp

or

cisco2-prp

.
.
.

cisco17-prp

The system would use a filename in this range from which to boot a default system image stored on a network TFTP server.

However, if the configuration file contains boot instructions, the system uses these instructions to boot the system, rather than using the filename it computed from the software configuration register settings.

Note If a bootable Cisco IOS software image exists in a Flash memory card inserted in PCMCIA slot 0 or slot 1, the software configuration register boot field setting is overridden and the system boots from the Cisco IOS software image in the Flash memory card, rather than from a network TFTP image (that is, from a computed filename in the range from *cisco2-grp* through *cisco17-grp*).

Changing the Software Configuration Register Settings

To change the software configuration register settings while running system software, perform the following steps:

Step 1 Enter the **enable** command and your password at the user EXEC mode prompt to establish the privileged EXEC mode:

```
Router> enable
Password:
Router#
```

Step 2 Enter the **configure terminal** command at the privileged EXEC mode prompt to establish the global configuration mode:

```
Router# conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```

Step 3 Set the contents of the software configuration register by entering the **config-register** *value* command at the global configuration mode prompt, where *value* is a hexadecimal number preceded by 0x.

Consult the hexadecimal column in Table 4-3 for the possible settings to enter as the 4-bit *value* parameter.

The **config-register** *value* command takes the following form:

```
Router(config)# config-register 0xvalue
```

Step 4 Exit the global configuration mode by entering **Ctrl-Z**:

```
Router(config)# config-register 0xvalue
Router(config)# Ctrl-Z
Router#
```

The new contents of the software configuration register are saved to NVRAM. However, these new settings do not take effect until you reload the system or reboot the router.

Step 5 To display the software configuration register setting that is currently in effect as a result of Step 3 (and which will be used at the next reboot of the router), issue the **show version** command at the privileged EXEC mode prompt:

```
Router#sh ver

.
.
.

#Configuration register is 0x141 (will be 0x102 at next reload)
```

The last line of the resulting display shows both the current configuration register setting and the new setting that will take effect when the system is reloaded or rebooted.

Step 6 Save the software configuration register setting, as described in the section entitled "Saving the Running Configuration Settings to NVRAM."

Step 7 Reboot the router.

The software configuration register setting takes effect only after you reload the system, such as when you issue the **reload** command from the console or reboot the router.

This completes the procedure for changing the contents of the software configuration register. You can set the boot field to enable any desired manual or automatic boot function.

Meaning of Bits in the Software Configuration Register

As described earlier, the four low-order bits in the software configuration register (bits 3, 2, 1, and 0) make up the *boot field* (see Table 4-4). This field specifies a number in binary form.

If you set the boot field value to 0, you must boot the system manually by entering the **boot** command at the ROM monitor prompt (`rommon>`).

If you set the boot field value to *0x2* through *0xF* and a valid **boot system** command is stored in the configuration file, the system boots the Cisco IOS software image as directed by that value. If no **boot system** command is present in the configuration file, the system computes a default boot filename for booting from a network TFTP server.

In the following example, the software configuration register has been set to boot the system from the Flash memory SIMM on the RP and to ignore the Break function at the next reboot of the router:

```
Router# conf term
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# config-register 0x0102
Router(config)# boot system flash [filename]
Ctrl-z
Router#
```

With the configuration register thus set to “0x0102,” the system computes a default boot filename. In forming this filename, the system starts with *cisco* and appends the octal equivalent of the boot field number, a hyphen, and the processor type (*grp* or *prp*).

Table 4-5 lists the range of possible computed default filenames for booting over the network. Note, however, that a valid **boot system** configuration command stored in the NVRAM configuration file overrides any computed default filename for booting over the network.

Table 4-5 Default Boot Filenames Computed from Boot Field Bits

Action/File Name	Bit 3	Bit 2	Bit 1	Bit 0
Bootstrap mode	0	0	0	0
Default software	0	0	0	1
cisco2-grp or cisco2-prp	0	0	1	0
cisco3-grp or cisco3-prp	0	0	1	1
cisco4-grp or cisco4-prp	0	1	0	0
cisco5-grp or cisco5-prp	0	1	0	1
cisco6-grp or cisco6-prp	0	1	1	0
cisco7-grp or cisco7-prp	0	1	1	1
cisco10-grp or cisco10-prp	1	0	0	0
cisco11-grp or cisco11-prp	1	0	0	1
cisco12-grp or cisco12-prp	1	0	1	0
cisco13-grp or cisco13-prp	1	0	1	1
cisco14-grp or cisco14-prp	1	1	0	0
cisco15-grp or cisco15-prp	1	1	0	1
cisco16-grp or cisco16-prp	1	1	1	0
cisco17-grp or cisco17-prp	1	1	1	1

The significance of other important bits in the software configuration register is described in the following paragraphs.

Bit 8 of the software configuration register controls the console Break function key. Setting bit 8 (the factory default) causes the system to ignore the console Break key. Conversely, clearing bit 8 causes the system to interpret activation of the Break key as a command, forcing the system into the ROM monitor mode (*rommon*>) and halting normal system operation. Regardless of the setting of the break enable bit in the software configuration register, activation of the Break key causes a return to the ROM monitor prompt during approximately the first 5 seconds of booting.

Bit 10 of the software configuration register controls the host portion of the IP broadcast address. Setting bit 10 causes the processor to use all zeros in the host portion of the IP broadcast address; clearing bit 10 (the factory default) causes the processor to use all ones. Bit 10 interacts with bit 14, which controls the network and subnet portions of the IP broadcast address.

Table 4-6 shows the combined effect of bits 10 and 14.

Table 4-6 Software Configuration Register Settings for Broadcast Address Destination

Bit 14	Bit 10	Address (net) (host)
Off	Off	(ones) (ones)
Off	On	(zeros) (zeros)
On	On	(net) (zeros)
On	Off	(net) (ones)

Bits 11 and 12 of the software configuration register determine the line (baud) rate of the console terminal. Table 4-7 shows the settings in this register that equate to the four available console baud rates. The factory default transmission rate for the console terminal is 9600 baud.

Table 4-7 Console Baud Rate Settings

Baud Rate	Bit 12	Bit 11
9600	0	0
4800	0	1
1200	1	0
2400	1	1

Bit 13 of the software configuration register determines the system's response to a bootload failure. Setting bit 13 causes the system to load Cisco IOS software from Flash memory after five unsuccessful attempts to load a boot file from the network TFTP server. Clearing

bit 13 causes the system to continue attempting to load a boot file from the network TFTP server indefinitely. By default, bit 13 in the software configuration register is set to 0 at the factory prior to router shipment.

Table 4-3 summarizes the functions of all of the bits in the software configuration register.

Recovering a Lost Password

This section tells you how to recover a lost password. The following is a general outline of the password recovery process:

1. Issue the **show version** command to determine the current contents of the software configuration register.
2. Break to the ROM monitor prompt (`rommon>`).
3. Change the software configuration register setting to 0x0040. This setting causes the system to ignore the contents of NVRAM, enabling you to see your password.
4. Enter the privileged EXEC mode.
5. Enter the **show startup-config** command to display the enable password.
6. Change the software configuration register value back to its original setting.

To recover a lost password, perform the following steps.

Note If the enable password is encrypted, the following procedure will not work for password recovery and you will have to reconfigure the system before attempting a reboot. To reconfigure the system, use the displayed configuration, as revealed by issuing the **show startup-config** command in the privileged EXEC mode (see Step 11).

Step 1 Attach an ASCII terminal to the RP console port.

Step 2 Configure the terminal to operate at 9600 baud, 8 data bits, no parity, and 2 stop bits (or to whatever settings the console port is currently set).

Step 3 Enter the **show version** command at the privileged EXEC mode prompt to display the current software configuration register setting:

```
Router#show version

.
.
.
```

Make a note of this current configuration setting, as displayed in the last line of the **show version** command output. You may need this value for later use (in Step 13).

Step 4 If the Break function is disabled, power cycle the router by turning off power to the power supply(ies), waiting 5 seconds, and then restoring power.

If the Break function is enabled, press the **Break** key or send a break signal by holding down the **Control** key and pressing the right square bracket key (^]).

Step 5 Within 5 seconds of power being restored to the router, press the **Break** key. This action causes the terminal to display the ROM monitor prompt, as follows:

```
rommon 1>
```

Step 6 Set the software configuration register to ignore the configuration file information, as indicated in the following sample display:

```
rommon 1> conf reg

Configuration Summary
enabled are:
console baud: 9600
boot: image specified by the boot system command
or default to: cisco2-grp

do you wish to change the configuration? y/n [n]: y
enable “diagnostic mode”? y/n [n]:
enable “use net in IP bcast address”? y/n [n]:
enable “load rom after netbootfails”? y/n [n]:
enable “use all zero broadcast”? y/n [n]:
enable “break/abort has effect?” y/n [n]:
enable “ignore system config info?” [n]: y
change console baud rate? y/n [n]:
change boot characteristics? y/n [n]
```

```
Configuration Summary
enabled are:
console baud: 9600
boot: image specified by the boot system command
or default to: cisco2-grp

do you wish to change the configuration? y/n [n]

You must reset or power cycle for the new config to take effect
```

Step 7 Initialize the router by entering the **initialize** command at the ROM monitor prompt:

```
rommon 1> i
```

The router power cycles, the software configuration register is set to ignore the configuration file, and the router boots the system image and displays the system configuration dialog:

```
         --- System Configuration Dialog ---

.
.
.
```

Step 8 Enter **no** in response to the system configuration dialog prompts until the following instruction is displayed:

```
Press RETURN to get started!
```

Step 9 Press **Return**.

After the interface configuration information is displayed, the user EXEC mode prompt appears:

```
Router>
```

Step 10 Issue the **enable** command at the user EXEC mode prompt to enter the privileged EXEC mode:

```
Router> enable
Router#
```

Step 11 Enter the **show start-up config** command at the privileged EXEC mode prompt to display the enable password in the configuration file:

```
Router# show start-up config

.
.
.
```

Step 12 Issue the **configure terminal** command at the privileged EXEC mode prompt to enter the global configuration mode:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```

Step 13 Change the software configuration register setting back to its original value (as noted earlier from Step 3). Alternatively, change this value to 0x0102 (the factory default) by issuing the **config-register 0xvalue** command:

```
Router(config)# config-register 0xvalue
Router(config)#
```

Step 14 Exit the global configuration mode by entering **Ctrl-Z**:

```
Router(config)# Ctrl-Z
Router#
```

Step 15 Reboot the router and enable it using the recovered password.

Using Flash Memory Cards in the RP

This section presents procedures for using Flash memory cards in the Route Processor (RP). The following topics are covered in this section:

- Installing and Removing a Flash Memory Card in a RP
- Formatting a Flash Memory Card
- Specifying a Cisco IOS Image for Booting the System
- Console Commands Associated with Flash Memory Use
- Enabling Booting from Flash Memory

- Copying Files to a Flash Memory Medium
- Copying a Cisco IOS Software Image onto a Flash Memory Card
- Copying Cisco IOS Software Images between Flash Memory Cards
- Copying System Configuration Files between RP Memory and a Flash Memory Card
- Recovering from Locked Blocks in Flash Memory Cards

Installing and Removing a Flash Memory Card in a RP

The RP has two PCMCIA slots (see Figure 4-3)—slot 0 on the left and slot 1 on the right—that accommodate the Flash memory cards that are used for storing system software images. Both PCMCIA slots can be used simultaneously.

To install a Flash memory card, perform the following steps:

Step 1 Facing the RP faceplate, hold the Flash memory card with the connector end of the card toward the slot and the label facing to the right (see Figure 4-3a).

Step 2 Insert the card into the slot until the card is completely seated in the connector at the back of the slot (see Figure 4-3b). The ejector button pops out when the card is seated.

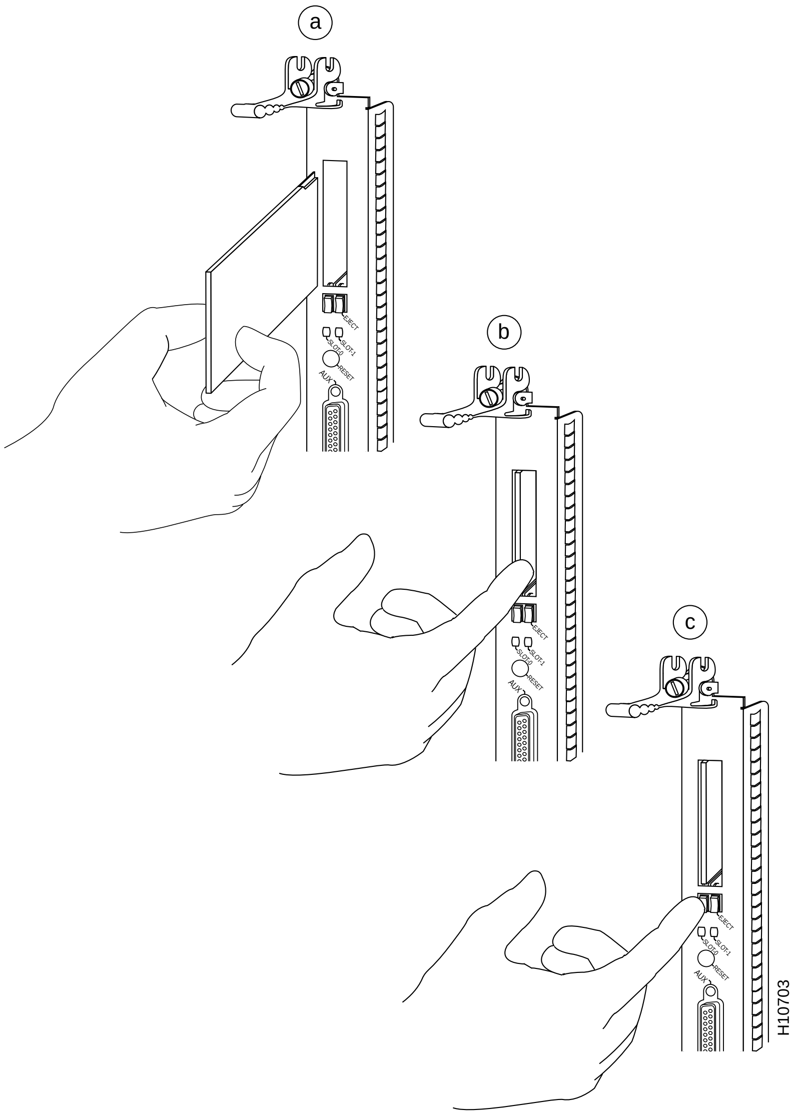
Note The Flash memory card is keyed for proper insertion. The ejector button will not pop out unless the card is properly inserted. Part of the card remains outside the slot, even when it is properly seated. *Do not attempt to force the card deeper into the slot after the ejector button pops out.*

To remove a Flash memory card, perform the following steps:

Step 1 To eject the card, press the ejector button to free the card from the connector at the back of the slot (see Figure 4-3c).

Step 2 Remove the card from the slot and place it in an antistatic bag for ESD protection.

Figure 4-3 Installing and Removing a Flash Memory Card



Formatting a Flash Memory Card

The Flash memory card that shipped with your router contains the default Cisco IOS image for booting your router.

In some cases, you might need to insert a new Flash memory card and copy images or backup configuration files to the card. However, before using a *new* Flash memory card, you must format it.

Note For the following procedure, it is assumed that you have already booted your router and that it is fully operational. Use only Type 1 or Type 2 Flash memory cards with the PCMCIA slots on the RP.

Caution The formatting procedure erases all information on a Flash memory card. If you want to save any data on a Flash memory card, copy the data to a server or another Flash memory card before formatting the card.

To format a new Flash memory card, perform the following steps:

Step 1 Insert the Flash memory card into PCMCIA slot 0 or slot 1.

In this procedure, slot 0 is used.

Step 2 Enter the **format slot0:** (or **format slot1:**) command at the privileged EXEC mode prompt:

```
Router# format slot0:
All sectors will be erased, proceed? [confirm]
Enter volume id (up to 30 characters): MyNewCard
Formatting sector 1
Format device slot0 completed
Router#
```

Note In this example, a 20-MB Flash memory card is being used. At the "Formatting sector" line in the sample display above, the system begins to count backward from 160 (the number of sectors on a 20-MB Flash memory card); when the count reaches "1," the formatting process is complete.

The new Flash memory card is now ready for use.

Specifying a Cisco IOS Image for Booting the System

Use the procedure in this section to identify a particular Cisco IOS software image (named *new.image*) that is to be made bootable from a Flash memory card.

The software configuration register must be set to “0x2102” during this procedure in order for the image to boot from a Flash memory card; accordingly, the **config-register** command must be included in the command sequence, as shown below:

```
Router# config terminal
Router(config)# no boot system
Router(config)# boot system flash slot0:new.image
Router(config)# config-register 0x2102
Ctrl-z
Router# copy running-config startup-config
Router# reload
```

When you issue the **reload** command, the specified file (*new.image*) on the Flash memory card inserted in PCMCIA slot 0 is used to boot the system.

If one of the following software configuration register settings were to be specified in the preceding example, the system would behave as described below:

- 0x2000—The system would boot a default Cisco IOS software image from a Flash memory card (if the network boot fails).
- 0x0100—The system would ignore the Break function.
- 0x0101—The system would boot the default image (the first image found) from the onboard Flash memory SIMM on the RP. This setting also tells the system that it should *not* reset the Break disable function, nor should it check for a default filename for booting over the network.
- 0x0002—The system would look in the Flash memory SIMM on the RP for a default Cisco IOS software image.
- 0x0102—The system would check for a default netboot filename, boot from a Flash memory card (if the netboot operation fails), and disable the Break function.

Console Commands Associated with Flash Memory Use

This section outlines the console commands for using the onboard Flash memory SIMM on the RP and the PCMCIA Flash memory cards.

To determine the type of Flash memory medium currently in effect for access, issue the **pwd** command at the privileged EXEC mode prompt:

```
Router# pwd
slot0
```

To change from one type of Flash memory access to another, issue the **change directory** (**cd** *device-name)* command, where *device-name* can be **slot0:**, **slot1:**, or **bootflash:**.

Sample uses of the **change directory** command follow:

```
Router# cd slot1:
Router# pwd
slot1
Router# cd slot0:
Router# pwd
slot0
Router# cd bootflash:
Router# pwd
bootflash
Router#
```

To list the directory contents of the Flash memory medium being used, issue the **directory** (**dir** [*device-name*]) command at the privileged EXEC mode prompt, where *device-name* can be *slot0:*, *slot1:*, or *bootflash:*.

A sample use of the **directory** command follows:

```
Router# dir
-#- -length- -----date/time------ name
1   4601977  May 10 1997 09:42:19 myfile1
6   679      May 10 1997 05:43:56 todays–config
7   1        May 10 1997 09:54:53 fun1
```

To delete a file from a Flash memory medium, issue the **delete** (**delete** *filename)* command at the privileged EXEC mode prompt, where *filename* represents any Flash memory file.

An example of deleting the file *fun1* from the current Flash memory directory follows:

```
Router# delete fun1
Router# dir
-#- -length- -----date/time------ name
1   4601977  May 10 1997 09:42:19 myfile1
6   679      May 10 1997 05:43:56 todays–config
```

Files that are deleted from the current Flash memory directory are marked as such, but they still occupy space in the Flash memory directory.

To permanently remove deleted files from a Flash memory directory but leave undeleted files intact, issue the **squeeze** *device-name* command at the privileged EXEC mode prompt, where *device-name* can be *slot0:*, *slot1:*, or *bootflash:*.

The **squeeze** command permanently removes deleted files and makes all other undeleted files contiguous, thus conserving storage space.

A sample **squeeze** command follows:

```
Router# squeeze slot0:
All deleted files will be removed, proceed? [confirm]
Squeeze operation may take a while, proceed? [confirm]
ebESZ
```

To prevent loss of data due to sudden power loss, the “squeezed” data is temporarily saved to another Flash memory area reserved specifically for system use.

In the preceding command display output, the character “e” in the last line indicates that the special Flash memory area has been erased. This erase operation must be accomplished before any write operation to the special Flash memory area can begin.

The character “b” indicates that the data about to be written to the special Flash memory area has been temporarily copied.

The character “E” signifies that the sector temporarily occupied by the data has been erased.

The character “S” signifies that the data has been written to its permanent location in Flash memory.

Note During the squeeze operation, the system maintains a log identifying which of the squeeze functions has been accomplished so that the system can return to the proper place and continue the operation in the event of a power failure.

The character "Z" indicates that the log has been erased following the successful squeeze operation.

Enabling Booting from Flash Memory

To enable booting from Flash memory, set the boot field in the software configuration register (bits 3 through 0) to a value between 2 and 15. These values are used with the **boot system flash** *device:filename* command, where *device* can be *slot0:*, *slot1:*, or *bootflash:*, and *filename* is the name of the file you want the system to boot.

For more detailed information about setting values in the software configuration register, refer to the earlier section entitled "Configuring the Software Configuration Register."

To enter the global configuration mode (while the system is running) and specify a Flash filename from which to boot the system, enter the **configure terminal** command at the privileged EXEC mode prompt:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# boot system flash device:filename
```

To disable the Break function and enable the **boot system flash** *device*:*filename* command, issue the **config-register** command at the global configuration mode with the configuration register value shown below:

```
Router(config)# config-reg 0x0102
Ctrl-z
Router#
```

Copying Files to a Flash Memory Medium

It is a good idea to copy a new Cisco IOS software image to a Flash memory medium (1) when a new image becomes available or (2) when you want to back up the image.

The information in this section enables you to copy any type of file to the Flash memory SIMM on the RP or to a PCMCIA Flash memory card inserted in either slot 0 or slot 1.

Caution You *cannot* copy a new Cisco IOS software image into the onboard Flash memory SIMM (also referred to as *bootflash*) while the system is running from onboard Flash memory.

Note When you upgrade Cisco IOS software images in Flash memory, do so one at a time; it is not good practice to delete all valid images in Flash memory at once. Also, to avoid losing valid Cisco IOS images, you should upgrade PCMCIA-based Flash memory separately from the onboard Flash SIMM on the RP.

To copy a file to Flash memory, issue the following command at the privileged EXEC mode prompt:

```
Router# copy tftp:filename [ bootflash: | slot0: | slot1: ]:filename
```

where:

The argument tftp*:filename* specifies the source and name of the file to be copied.

The variable [*bootflash:* | *slot0:* | *slot1:*]:*filename* specifies the destination and name of the file to be copied. The option *bootflash* specifies that the file is to be copied to the onboard Flash memory SIMM on the RP; the option *slot0:* specifies that the file is to be copied to the PCMCIA Flash memory card in slot 0; the option *slot 1:* specifies that the file is to be copied to the PCMCIA Flash memory card in slot 1.

Typical output generated by a **copy tftp:filename** command follows:

```
Router# copy tftp:myfile1 slot0:myfile1
20575008 bytes available on device slot0, proceed? [confirm]
Address or name of remote host [1.1.1.1]?
Loading new.image from 1.1.1.1 (via Ethernet0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 7799951/15599616 bytes]
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
Router#
```

In this example, the exclamation points (!!!) appear as the source file is being downloaded to the destination device. The “C” characters indicate that a cyclic redundancy check (CRC) is being calculated during the downloading process. The CRC verifies that the file has been correctly downloaded to the destination device (the Flash memory card inserted in PCMCIA slot 0).

Copying a Cisco IOS Software Image onto a Flash Memory Card

You can copy a Cisco IOS software image onto a Flash memory card at any time for later use.

However, you must first format the Flash memory card that you intend to use in the copy operation. If you have not already formatted the card, refer to the earlier section entitled “Formatting a Flash Memory Card.”

The following assumptions apply for the Flash memory card copying procedures in this section:

- You have a formatted Flash memory card inserted in a PCMCIA slot in the RP.
- You know the name of the file you want to copy to the Flash memory card.
- You have a valid, bootable Cisco IOS software image stored in the onboard Flash memory SIMM, enabling you to start the router.
- The bootable Cisco IOS software image that you want to copy to the Flash memory card in the PCMCIA slot exists on a TFTP server somewhere in the network.
- You have access to the network TFTP server by means of a configured and fully functional network interface on your system.

  To ensure access to the network TFTP server, you must configure one network interface using the **setup** command facility.

  For instructions on using the TFTP facility, refer to the section entitled "Using the Setup Facility or the Setup Command." You can also refer to the document entitled *Configuration Fundamentals Configuration Guide*.

To copy a bootable image onto a Flash memory card, perform the following steps:

Step 1 Boot the router and allow it to initialize.

Step 2 Issue the **enable** command at the user EXEC mode prompt to establish the privileged EXEC mode:

```
Router> enable
Password:
Router#
```

Step 3 Copy the file named *new.image* to the Flash memory card inserted in PCMCIA slot 0 by issuing the following command:

```
Router# copy tftp:new.image slot0:new.image
20575008 bytes available on device slot0, proceed? [confirm]
Address or name of remote host [1.1.1.1]?
Loading new.image from 1.1.1.1 (via Ethernet0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 7799951/15599616 bytes]
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCC
Router#
```

In this example, the exclamation points (!!!) appear as the source file is being downloaded (copied) to the destination device. The “C” characters indicate that a CRC is being calculated during the downloading process. The CRC verifies that the file has been correctly copied to the destination device (the Flash memory card inserted in PCMCIA slot 0).

Step 4 Reboot the system.

This completes the procedure for copying a bootable image onto a Flash memory card.

Copying Cisco IOS Software Images between Flash Memory Cards

As future releases of Cisco IOS software become available, you will receive each image as a file booted from a network TFTP server, as a file on floppy disk, or as a file on a Flash memory card.

The procedures in this section tell you how to use a newly released Cisco IOS software image on a Flash memory card in a system that has (1) an older Cisco IOS image residing on a Flash memory card inserted in PCMCIA slot 0 and (2) a default Cisco IOS software boot image stored in the onboard Flash memory SIMM on the RP.

In this procedure, you will be copying an updated Cisco IOS software image from a new Flash memory card onto a Flash memory card containing an old Cisco IOS software image.

For purposes of this procedure, the following filenames apply:

- *image.new*—The new image on the new Flash memory card.
- *image.old*—The old image on the old Flash memory card inserted in slot 0.
- *image.boot*—The bootable Cisco IOS software image stored in the onboard Flash memory SIMM. (This image is used by default to boot the system if no other bootable image is available.)

Note In this procedure, it is assumed that the new Cisco IOS software image will fit on the old Flash memory card inserted in slot 0, together with the old image. If sufficient space is not available for both images on the old Flash memory card, use the **delete** command to delete files from the old Flash memory card; however, *do not* delete the *image.old* file. After deleting files, use the **squeeze** command to permanently remove the deleted files from the old Flash memory card. (For information on the use of the **squeeze** command, refer to the section entitled "Console Commands Associated with Flash Memory Use." If, after you delete files and use the **squeeze** command, the two files still cannot coexist on the Flash memory card in slot 0, remove this card, place it in an antistatic bag for ESD protection, and store it in a safe place. Insert the new Flash memory card (containing *image.new*) in slot 0. Proceed to Step 5 in the following procedure and issue the command **boot system flash** *slot0:image.new* to designate the file *image.new* as the new default Cisco IOS software boot image.

To copy a bootable Cisco IOS software image between Flash memory cards, perform the following steps:

Step 1 Boot the router.

In this procedure, the file named *image.boot* is the default boot image.

Step 2 Enable the router to bring up the privileged EXEC mode prompt:

```
Router> enable
Password:
Router#
```

Step 3 Insert the new Flash memory card in PCMCIA slot 1.

Step 4 Issue the following command to copy the file *image.new* in slot 1 to the Flash memory card inserted in PCMCIA slot 0.

Note Take this step only if sufficient space is available on the old slot 0 Flash memory card to accommodate the new image (in addition to the old image it already contains).

```
Router# copy slot1:image.new slot0:image.new
```

You can also enter this command in the following form to achieve the same result:

```
Router# copy slot1:image.new slot0:
```

In the latter case, the name of the file is carried along with the copied image.

Step 5 Issue the following commands to designate the file named *image.new* (in the Flash memory card in slot 0) as the new default system image for boot purposes:

```
Router# config t
Router(config)# no boot system
Router(config)# boot system flash slot0:image.new
Ctrl-z
Router# copy running-config startup-config
Router# reload
```

When the system reloads, the file *image.new* is booted from the Flash memory card inserted in slot 0.

This completes the procedure for copying a bootable image between Flash memory cards inserted in the PCMCIA slots.

Copying System Configuration Files between RP Memory and a Flash Memory Card

Copying a configuration file to a Flash memory card inserted in PCMCIA slot 0 or slot 1 might be required if you do not have access to a TFTP server on which you can temporarily store a configuration file.

To copy a system configuration file, consult the following sections, as appropriate:

- Copying a Configuration File from NVRAM to a Flash Memory Card
- Copying a Configuration File from DRAM to a Flash Memory Card
- Copying a Configuration File from a Flash Memory Card to NVRAM

Copying a Configuration File from NVRAM to a Flash Memory Card

To copy a configuration file from NVRAM to a Flash memory card, perform the following steps:

Step 1 Issue the **show boot** command at the privileged EXEC mode prompt to display the current setting for the environmental variable CONFIG_FILE:

```
Router# show boot

[display text omitted]

CONFIG_FILE variable =
Current CONFIG_FILE variable =

[display text omitted]
```

The absence of any notation following the CONFIG_FILE variable statement in this sample display indicates that the environmental variable is pointing to NVRAM (the system default).

Step 2 To invoke the copy operation, issue a **copy** command in the following form at the privileged EXEC mode prompt:

copy startup-config [**slot0:** | **slot1:**]:***filename***

where:

startup-config is the source of the file to be copied (NVRAM)

[**slot0:** | **slot1:**]:*filename* is the destination of the file (the Flash memory card in either slot 0 or slot 1) and its name.

To initiate the copy operation at the privileged EXEC mode prompt, issue the following command:

```
Router# copy startup-config slot0:myfile2
20575008 bytes available on device slot0, proceed? [confirm]
Address or name of remote host [1.1.1.1]?
Loading new.image from 1.1.1.1 (via Ethernet0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 7799951/15599616 bytes]
```

```
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCC
Router#
```

Note In this example, the exclamation points (!!!) appear as the file is being copied. The "C" characters signify the calculation of the CRC. The CRC verifies that the file has been copied correctly.

Step 3 To further verify that the configuration file was copied correctly to the Flash memory card inserted in slot 0, issue the **directory** command:

```
Router# dir slot0:
-#- -length- -----date/time------ name
1   5200084  May 10 1997 19:24:12 gsr-p-mz.112-8
3   1215     May 10 1997 20:30:52 myfile1
4   6176844  May 10 1997 23:04:10 gsr-p-mz.112-8.1
5   1186     May 10 1997 16:56:50 myfile2

9197156 bytes available (11381148 bytes used)
Router#
```

Copying a Configuration File from DRAM to a Flash Memory Card

To copy a configuration file from DRAM to a Flash memory card, perform the following steps:

Step 1 Issue the command for copying a configuration file from DRAM to a Flash memory card. The command takes the following form:

copy startup-config [**slot0:** | **slot1:**]:***filename***

where:

copy startup-config specifies the source file to be copied from DRAM.

[**slot0:** | **slot1:**]:*filename* specifies the destination of the configuration file to be copied (the Flash memory card inserted in either slot 0 or slot 1) and its name.

To initiate the copy operation, issue the following command at the privileged EXEC mode prompt:

```
Router# copy running-config slot0:myfile2
20575008 bytes available on device slot0, proceed? [confirm]
Address or name of remote host [1.1.1.1]?
Loading new.image from 1.1.1.1 (via Ethernet0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!![OK - 7799951/15599616
bytes]
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
Router#
```

Note In this example, the exclamation points (!!!) appear as the file is being copied. The "C" characters signify the calculation of the CRC. The CRC verifies that the file has been copied correctly.

Step 2 To further verify that the file was copied correctly, issue the **directory** command at the privileged EXEC mode prompt:

```
Router# dir slot0:
-#- -length- -----date/time------ name
1   5200084  May 10 1997 19:24:12 gsr-p-mz.112-8
3   1215     May 10 1997 20:30:52 myfile1
4   6176844  May 10 1997 23:04:10 gsr-p-mz.112-8.1
5   1186     May 10 1997 16:56:50 myfile2

9197156 bytes available (11381148 bytes used)
```

Copying a Configuration File from a Flash Memory Card to NVRAM

To copy a configuration file from a Flash memory card inserted in PCMCIA slot 0 or slot 1 to NVRAM, perform the following steps:

Step 1 Issue the command for copying a configuration file from a Flash memory card to NVRAM. This command takes the following form:

copy [**slot0:** | **slot1:**]:*filename* **startup-config**

where:

[**slot0:** | **slot1:**]:*filename* is the source of the file to be copied (the Flash memory card inserted in PCMCIA slot 0 or slot 1).

startup-config is the destination (NVRAM) of the file to be copied.

To initiate the copy operation, issue the following command at the privileged EXEC mode prompt:

```
Router# copy slot0:myfile startup-config
[ok]
Router#
```

Step 2 Issue the following command to ensure that the startup configuration file, now stored in NVRAM, is designated as the default running configuration file for the system:

```
Router# copy startup-config running-config
Router#
%SYS-5-CONFIG_I: Configured from memory by console
Router#
```

Recovering from Locked Blocks in Flash Memory Cards

A locked block in a Flash memory card occurs when power is lost or a Flash memory card is removed during a write or erase operation. The only way to recover from locked blocks in a Flash memory card is to reformat the card using the **format** command.

Caution Formatting a Flash memory card erases all data on the card.

When a block of Flash memory is locked, it cannot be written to or erased. Any attempt to do so will consistently fail at the blocked location.

What to Do Next?

After you have installed the Cisco 12008, checked all external connections, turned on system power, allowed the system to boot up, and minimally configured the system, you might need to perform additional configuration tasks. For more detailed information about configuring the router and its interfaces, refer to the publications listed in the following section.

Note For additional information about the Cisco 12000 series line cards, refer to the individual line card configuration note(s) for your installed line cards.

If You Need More Configuration Information

Additional information about Cisco IOS software is available from the following sources:

- The Documentation CD-ROM.

  Cisco documentation and additional literature are available in a CD-ROM package, which ships with your product. The Documentation CD-ROM, a member of the Cisco Connection Family, is updated monthly. Therefore, it might be more up to date than printed documentation. To order additional copies of the Documentation CD-ROM, contact your local sales representative or call customer service. The CD-ROM package is available as a single package or through an annual subscription.

- The section entitled “Obtaining Documentation.”
- Customer Service at 800 553-6387 or 408 526-7208. Customer Service hours are 5:00 a.m. to 6:00 p.m. Pacific time, Monday through Friday (excluding company holidays). You can also send e-mail to cs-rep@cisco.com.
- The *Cisco Information Packet* that shipped with your router.

- For systems with Cisco IOS Release 11.2(8)GS or later, refer to the following modular configuration and command reference publications, as appropriate, for your system configuration:
  - — *Configuration Fundamentals Configuration Guide*
  - — *Configuration Fundamentals Command Reference*
  - — *Wide-Area Networking Configuration Guide*
  - — *Wide-Area Networking Command Reference*
  - — *Network Protocols Configuration Guide*, *Parts 1*, *2,* and *3*
  - — *Network Protocols Command Reference*, *Parts 1*, *2,* and *3*
  - — *Configuration Builder Getting Started Guide*
  - — *Troubleshooting Internetworking Systems*
  - — *Debug Command Reference*
  - — *System Error Messages*
  - — *Cisco IOS Software Command Summary*
  - — *Cisco Management Information Base (MIB) User Quick Reference*
- For additional line card interface configuration information, refer to the following publications:
  - — The configuration note *Quad OC-3c/STM-1c Packet-Over-SONET Line Card Installation and Configuration* (document number 78-4333-02) that shipped with your Quad OC-3c/STM-1c POS line card
  - — The configuration note *OC-12c/STM-4c Packet-Over-SONET Line Card Installation and Configuration* (document number 78-4341-02) that shipped with your OC-12c/STM-4c POS line card
  - — The configuration note *OC-12c/STM-4c Asynchronous Transfer Mode Line Card Installation and Configuration* (document number 78-4344-02) that shipped with your OC-12c/STM-4c ATM line card

- For additional information about the GRP, refer to the configuration note *Gigabit Route Processor Installation and Configuration* (document number 78-4339-02) that shipped with your GRP.
- For additional PRP information, refer to the configuration note Performance Route Processor (PRP) Installation and Configuration (Document Number 78-13302-xx) that accompanied your PRP.

Troubleshooting the Installation

Your Cisco 12008 was subjected to extensive testing and burn-in before being shipped from the factory. However, if you encounter problems starting up the router, the information in this chapter will help you to isolate the probable cause.

This chapter contains the following sections:

- Troubleshooting Overview
- Troubleshooting the Power Subsystem
- Troubleshooting the Processor Subsystem
- Troubleshooting the Cooling Subsystem
- Additional Troubleshooting Reference Information

In this chapter, it is assumed that you are troubleshooting the initial Cisco 12008 system startup, and that the system is in the original factory configuration. If you have removed or replaced components or changed any default settings, the recommendations in this chapter might not apply.

At initial system startup, you should verify the following:

- External power cables are connected, and proper source power is being supplied.
- The card cage fan tray and the power supply fan tray are operating.
- The system software boots successfully.
- The RP and the line cards are properly installed in their slots; each card initializes (is enabled by system software) without problems.

If you cannot solve a problem, contact a customer service representative for assistance. When you call, have the following information at hand:

- Date you received the router and the chassis serial number
- Line card configuration (the line cards installed in your system)
- The version number of the Cisco IOS software running on your system
- Brief description of the problem being experienced and the steps you have already taken to isolate and resolve the problem
- Maintenance agreement or warranty information

Troubleshooting Overview

This section identifies the normal status of the system at startup. It also describes the methods used in troubleshooting the Cisco 12008. To enable efficient problem solving, the troubleshooting methods are presented organized according to the router's major subsystems.

Normal System Status at Startup

Table 5-1 shows the contents of the alphanumeric displays on the RP and the line cards at system startup; this table also shows the normal, expected state of the LEDs on the faceplate of the CSC(s) at system startup.

For the layout of the status LEDs on the CSC faceplate, refer to Figure 1-14.

Table 5-1 Status of Alphanumeric Displays and LEDs at System Startup

Card	LED Function	Display Contents/LED Status/Meaning
RP	LED alphanumeric displays	MSTR (top) RP (bottom) The RP is enabled and recognized by the system; a valid Cisco IOS software image is running.
Line card	LED alphanumeric displays	IOS (top) RUN (bottom) The line card is enabled and ready for use.
CSC(s)	System alarm LEDs	CRITICAL: OFF MAJOR: OFF MINOR: OFF No system alarm conditions exist.
	CSC Status LEDs	FAIL: OFF ENABLED: ON The CSC is functional.
	FAN FAIL Status LEDs	LINECARD (left LED): OFF PWR SPLY (right LED): OFF The fan trays are operational.
	SFC Status LEDs	FAIL (top): OFF ENABLED (bottom): ON All the SFCs are functional.
AC-input power supply	Power status LEDs	AC INPUT OK (top): ON OUTPUT FAIL (bottom): OFF The power supply voltages are present and within tolerance.
DC-input power supply	Power status LEDs	INPUT OK (top): ON OUTPUT FAIL (bottom): OFF The power supply voltages are present and within tolerance.

Problem Solving Using a Subsystem Approach

The key to solving system problems is to try to isolate the difficulty to a specific subsystem. The first step in solving startup problems, for example, is to compare what the system *is doing* to what it *should be doing*.

Since a startup problem is usually attributable to a single component, it is more effective to isolate the problem to a specific subsystem, rather than trying to troubleshoot each system component.

For purposes of the troubleshooting procedures in this chapter, the Cisco 12008 will be regarded as consisting of the following subsystems:

- Power subsystem—The power subsystem consists of the following components:
  - AC-input power supplies or DC-input power supplies—The Cisco 12008 can be configured to operate with either source AC power or source DC power.

    Note An AC-input power supply and a DC-input power supply cannot be used together in the same Cisco 12008 chassis.

    A Cisco 12008 can be configured to operate with either a single AC-input power supply or a single DC-input power supply. Adding a second power supply of the same type provides redundancy (backup power capability) and enables the power supplies to share the current load for the router.
  - DC-DC converters—A DC-DC converter is incorporated into each of the cards that you can install in the upper card cage (the RP, CSCs, and line cards) or the lower card cage (the SFCs). The DC-DC converter on each card operates under control of its onboard MBus module.

    The converter takes the –48 VDC supplied to the card through the backplane from the power supply(ies) and converts it into the +3.3 VDC and +5 VDC required by the card's circuitry.
- Cooling subsystem—The cooling subsystem consists of two fan trays: one for the card cage and one for the power supply bays.

Each fan tray incorporates individual fans that draw +24 VDC from a DC-DC converter on the CSC that operates under control of its onboard MBus module. Both fan trays should begin to operate about two seconds after application of system power.

The fan trays incorporate a variable-speed feature, enabling the fans to run at a slower speed (when the internal chassis temperature remains within the normal operating range) or to run at a higher speed (when the internal temperature of the router exceeds a specified threshold). In the latter case, the voltage being delivered to the fans is increased, causing them to run at maximum speed to force a greater volume of air through the router.

In a noisy, air-conditioned environment, it may be difficult to hear whether or not the fan trays are operating. The first indication of a fan failure comes from the side-by-side fan tray status LEDs on the CSC faceplate (see Figure 1-14).

If the LED on the left is on (amber), a fan failure has occurred in the card cage fan tray. If the LED on the right is on (amber), a fan failure has occurred in the power supply fan tray.

Each fan in a fan tray is monitored separately for failure. A failed fan is not shut off in the usual sense; instead, a current-limiting feature in the faulty fan prevents it from interfering with the operation of other fans. The most common fan failure is that the fan just stops running, but continues to draw current.

If a fan in the card cage fan tray or the power supply fan tray fails, the CSC increases the voltage being delivered to the fans, causing them to run at maximum speed to compensate for the failed fan.

You can make a gross assessment of fan tray operation by placing your hand near the exhaust vents at the top rear of the router enclosure. A reduced flow of air from the card cage exhaust vent or the power supply exhaust vent may indicate that one or more fans on a given fan tray have failed. However, this method of checking fan operation is neither definitive nor reliable.

If you determine that a fan tray is not operating properly, you should immediately consider replacing the faulty fan tray to guard against an overheating condition in the router that could approach the shutdown threshold.

No operating adjustments can be made for either fan tray. An individual fan is either operating normally or it is not operating at all.

- Processor subsystem—The processor subsystem includes the RP and all installed line cards. Each line card has an onboard processor, to which the RP downloads a copy of the Cisco IOS operating image.

  A line card or RP that is not firmly seated in the backplane might cause the system to hang and crash. Two 4-character alphanumeric displays at the bottom of the RP and each line card provide status and error messages that can be an aid in troubleshooting.

Identifying Startup Problems

Startup problems are commonly due to problems with source power or to a card that is not properly seated in the backplane.

Normal System Startup Sequence

Each card installed in the system incorporates an MBus module and at least one DC-DC converter. The MBus module on each card provides an interface to the RP via the system's maintenance bus (MBus); the MBus module on each card also controls its own onboard DC-DC converter.

When you first start up the router, the following sequence of events occurs:

- Each MBus module receives +5 VDC directly from the power supply(ies) through the backplane. When the power supply power switches are turned on, each MBus module powers up. As it does so, the MBus module processor boots from its onboard EEPROM.
- As part of the boot process, each MBus module processor reads a set of ID pins on the card. These pins, whose meaning is determined at the time of card manufacture, identify the kind of card on which the MBus module is mounted.
- In the case of the MBus modules on the CSC and the RP, the CSC MBus module processor immediately enables the card's DC-DC converter, followed by that of the RP. (The CSC takes precedence in the system power-up sequence, because it supplies master clocking services to the entire system.)

  If the onboard MBus module determines that it is mounted on a line card or an SFC, the MBus module remains idle for the time being, leaving the card powered down until it receives power up instructions from the master MBus module on the RP.

- The MBus module on the RP monitors the progress of the CSC power-up sequence. When the CSC is powered up, the MBus module on the RP turns on its DC-DC converter to power its own electronics.
- The master MBus module on the RP then sends instructions to each line card and each SFC to power up; the MBus module on each card then turns on its own onboard DC-DC converter.
  - The MBus module on each line card monitors its progress during the power-up sequence. During this process, the line card processor performs its own boot sequence to load line card operating software. When the line card boot process is complete, the card communicates its status to the master MBus module on the RP.
  - The MBus module on each SFC also monitors its own progress during the power-up sequence. When the SFC boot process is complete, the cards likewise communicate their status to the master MBus module on the RP.
- As the power on and boot process progresses for the RP and each installed line card, the status of each card is given in the alphanumeric displays near the bottom of its faceplate.

  The top display is powered by the DC-DC converter on the card; the bottom display is powered by the +5 VDC provided through the backplane by the AC-input or DC-input power supply(ies).

By checking the status LEDs on the power supply(ies) and the alphanumeric displays on the RP and each line card, you can generally determine when and where the system failed during the startup sequence.

The following section describes what you should expect to see in the power supply LEDs on system startup.

Power Supply Status LEDs

When you start up the system by turning on the rotary power switch on the power supply faceplate, the following should occur:

- The green INPUT OK LED on each DC-input power supply or the green AC INPUT OK LED on each AC-input power supply should go on immediately and stay on as long as source power is applied to the system.

If this LED does not go on, or if it goes off while system power is still applied, there could be a problem with either the source power itself or the DC output voltages being delivered to the backplane (+5 VDC and –48 VDC). There could also just be a problem with the MBus controller inside the power supply.

The AC INPUT OK LED (AC-input power supply) or the INPUT OK LED (DC-input power supply) stays on when all of the following conditions are satisfied:

— The power supplies are on and receiving normal source power.

  The source power specifications for the AC-input power supply are 180 VAC to 264 VDC, 50 to 60 Hz, single phase.

  The source power specifications for the DC-input power supply are –40.5 VDC to –70 VDC.

— The power supplies are providing the nominal +5.2 VDC and –48 VDC operating voltages to the backplane.

If the AC or DC source power or the DC operating voltages being supplied to the backplane fall outside the allowable tolerances, the OUTPUT FAIL LED on the power supply goes on, because a problem with either of the DC operating voltages being supplied to the backplane prevents the system from starting up or continuing normal operations.

For example, if a problem occurs with the –48 VDC line that supplies power to the router’s internal components (see Figure 1-23), the system fails during the boot sequence.

Depending on when the OUTPUT FAIL LED goes on, proceed as follows:

— If the AC INPUT OK LED (AC-input power supply) or the INPUT OK LED (DC-input power supply) stays off when system power is applied, there is a problem with either the AC or the DC source power or the connection to the power supply. In this case proceed to the section entitled “Troubleshooting the Power Subsystem.”

— If the AC INPUT OK LED (AC-input power supply) or the INPUT OK LED (DC-input power supply) goes on temporarily and then goes off within 30 seconds, the system is probably shutting itself down because it detected an out-of-tolerance power or temperature condition within a power supply. In this case proceed to the section entitled “Troubleshooting the Power Subsystem.”

- If the AC INPUT OK LED (on the AC-input power supply) or the INPUT OK LED (on the DC-input power supply) goes on, and the system starts up as expected but then displays the following message and shuts down after 2 minutes, there may be a problem with one of the fan trays.

  ```
  %ENVM-2-FAN: Fan has failed, shutdown in 2 minutes
  ```

  In this case, proceed to the section entitled "Troubleshooting the Cooling Subsystem."

- If the red OUTPUT FAIL LED goes on (when a failure occurs with a power supply of either type), yet the system starts up correctly, displays the preceding message, and shuts down after about 2 minutes, there may a problem with the –48 VDC being supplied to the chassis. In this case, proceed to the section entitled "Troubleshooting the Power Subsystem."

• When you turn on the rotary power switch, you should hear the fan trays come up to normal rotational speed after about two seconds.

  If background noise prevents you from hearing fan tray operation, place your hand at the top rear of the router enclosure to determine if air is being exhausted from the fan tray vents. You should feel a steady volume of air coming from these vents.

  If the AC INPUT OK LED (AC-input power supply) or the INPUT OK LED (DC-input power supply) is on, but the fan trays are not operating, there might be a problem with the fan trays (or, possibly, the CSC, which powers the fan trays).

  To check the operating voltage of the fan trays, issue either the **show environment** or the **show environment all** command. (Either command displays information about the system's internal environment.) If the fan tray voltage is okay, the fan trays themselves may be faulty. If the fan tray voltage is bad, there may be a problem with the CSC (which supplies the fan tray operating voltages).

  If the system detects that it is overheating due to a fan tray failure, it shuts itself down. In this case, proceed to the section entitled "Troubleshooting the Cooling Subsystem."

• When you turn on system power, the alphanumeric displays on the RP indicate the following:

  - The top display indicates which component is running.
  - The bottom display indicates the current stage of the boot process.

Troubleshooting the Power Subsystem

The power subsystem in the Cisco 12008 consists of the following:

- AC-input or DC-input power supply(ies)
- MBus modules on the individual cards
- DC-DC converters on the individual cards
- Power distribution system in the Cisco 12008 (see Figure 1-23)

Each power supply provides +5.2 VDC and –48 VDC output voltages to the backplane. The +5.2 VDC output powers the MBus modules on each card in the system. The MBus modules, in turn, control the DC-DC converters on each card. The DC-DC converter takes the –48 VDC from the power supply and converts it into the various voltages required to operate card circuitry.

To begin checking the power subsystem, examine the status of the two LEDs on the power supply faceplate at initial system startup for the following conditions:

- The AC INPUT OK LED on the AC-input power supply or the INPUT OK LED on the DC-input power supply goes on when the rotary power switch on the power supply faceplate is turned on (|) and the unit is receiving source AC or DC power.
- The OUTPUT FAIL LED is normally off, but it goes on if the power supply output voltage is not within tolerance.

In systems with a single AC-input power supply or a single DC-input power supply, and in systems with redundant power when both power supplies are being shut down, the OUTPUT FAIL LED goes on momentarily as the system shuts down, but goes off and remains so when the power supply completely shuts down.

Each AC-input or DC-input power supply is monitored by its own onboard MBus module, as well as by the master MBus module on the RP. Each power supply is monitored for internal temperature conditions, overvoltage conditions, and overcurrent conditions.

Continue checking the power subsystem by assessing the following:

- Is the AC INPUT OK LED (AC-input power supply) or the INPUT OK LED (DC-input power supply) on?
  - If the answer is yes, source power is present and within tolerance; the power supplies are functional.

- — If the answer is no, but the fan trays are operating and the alphanumeric displays on the RP and line cards are functional, the likely suspect is a faulty power supply LED.

  The MBus modules driving the alphanumeric displays are powered by +5.2 VDC from the power supply.

  The fan trays are powered by +24 VDC from the DC-DC converter on the CSC; hence, if the RP and the fan trays are operating normally, all internal DC voltages are within tolerance.

  You can issue the **show environment** command at the user EXEC mode prompt to display temperature and voltage information for each installed card in the system.

- — If the answer is no and there is no other obvious system activity, verify that the rotary power switch on the power supply is in the fully clockwise ON (|) position. If it is not, turn the power switch clockwise until you hear an audible click, ensuring that the switch is in the full ON position and that the latching mechanism has been engaged.

- If the rotary power switch is set correctly and the AC INPUT OK LED (on the AC-input power supply) or the INPUT OK LED (on the DC-input power supply) still remains off, examine the source AC or source DC power cable.

  If the internal circuit breaker of the power supply has been tripped, you can reset it by turning the rotary power supply switch OFF then ON again. However, note that the tripping of the internal circuit breaker is a likely indication of an electrical problem in the chassis.

- Turn the rotary power switch OFF (O); check the state of the source AC or DC circuit breaker, as appropriate. Verify that the breaker is ON and that it has not been tripped. Verify that the source circuit breaker has the proper current rating.

Note Each power supply in the Cisco 12008 should be attached to a separate power source.

- In systems powered by source AC, there might be an uninterruptable power supply (UPS) for each installed AC-input power supply. Check that the UPS is functioning correctly.

- In systems powered by source DC, check the cable connections to the terminal studs on the DC-input power supply faceplate to ensure that the correct polarity (+ and –) has been observed in making the connections.
- Is the power cord (AC) or the power cable (DC) from the power source to the router in good condition and not damaged? If insulation on the cord or the cable appears cracked or broken, or if the AC plug or the DC terminal lugs appear to be loose, do not use the item. Immediately replace it with a new AC power cord or a new DC power cable.
- If the AC INPUT OK LED (AC-input power supply) or the INPUT OK LED (DC-input power supply) still fails to go on after you connect the power supply to a new power source, swap the existing power cord or cable with a replacement unit.
- Turn the rotary power switch back ON. If the AC INPUT OK LED (AC-input power supply) or the INPUT OK LED (DC-input power supply) goes on, return the first power cable for replacement.
- If the AC INPUT OK LED (AC-input power supply) or the INPUT OK LED (DC-input power supply) still fails to go on when the router is connected to a different power source with a new power cable, the power supply itself is probably faulty.
- If a spare power supply is available, replace the existing power supply with the spare unit and restart the system. If the AC INPUT OK LED (AC-input power supply) or the INPUT OK LED (DC-input power supply) goes on, return the faulty power supply for replacement.

If you are unable to resolve the problem, or if you determine that either the power supply or the power cord (AC) or power cable (DC) is faulty, contact your Cisco service representative for assistance.

Troubleshooting the Processor Subsystem

The Cisco 12008 processor subsystem consists of the RP and the line cards.

The RP and the line cards each have two onboard processors. One processor serves as the card's main processor, and the other serves as the MBus module processor. The latter monitors the card's environment and controls the card's onboard DC-DC converter.

The MBus module processor begins to operate as soon as power is applied to the system. The MBus processor determines what type of card it is mounted on and whether it should turn on the card's DC-DC converter. The master MBus module on the RP turns on card power after a brief delay; the MBus modules on the line cards delay turning on power until they receive a command to do so from the RP master MBus module.

To operate at all, a minimally configured Cisco 12008 must have a RP. However, the system can operate without any line cards, as long as no line card is in *partial* contact with the backplane pins.

A line card that is only partially inserted into the backplane sends incomplete signals to the RP, which can cause the system to hang. First ensure that the RP is installed properly and that the system software has initialized successfully. Then, if necessary, you can troubleshoot the individual line cards.

A power-on self-test (POST) runs immediately at power-on to determine the condition of RP memory. The results of this test appear in the alphanumeric display as a pass/fail message.

Troubleshooting the RP

To isolate a problem with the RP, assess the following:

- Are both RP alphanumeric displays on?
  - If both displays are off, the RP may not be fully seated in the backplane, there may be a problem with the MBus module on the RP, or the system power supply may be off.

    The two alphanumeric displays are powered separately. The top display receives power from the onboard DC-DC converter of the RP. The bottom display is powered directly from the MBus by means of the power supply(ies). Thus, even if the RP has not powered up, the bottom display could be on.
  - If both displays are on, check the message being displayed.

    As soon as the DC-DC converter is turned on by the MBus module, the RP processor begins the boot process. Status messages are displayed as the boot process continues (see Table 5-2).

Some messages appear briefly (millisecond duration), and others last several seconds. If one of the messages appears frozen, the boot process could be hung. Note the message being displayed on a piece of paper. Turn off the system power supply power switches, then turn them back on to reset the system and start the boot process anew. If the system hangs again, the RP could be faulty and in need of replacement.

Table 5-2 RP Alphanumeric Display Messages

Top Display	Bottom Display	Message
LMEM	TEST	Low memory test running
LCAH	INIT	Lower 15K cache initialization
BSS	INIT	Initialize main memory for ROM
NVRAM	INIT	Initialize NVRAM
EXPT	INIT	Initialize interrupt handlers
TLB	INIT	Initialize TLB
CACH	INIT	Initialize CPU data and instruction cache
CACH	PARY	Enable CPU cache parity
MEM	INIT	Initialize main memory
NVRAM	SIZE	Size the NVRAM
PCMC	INIT	Initialize the PCMCIA
EXIT	INIT	Exit the initialization sequence
IOS	UP	The Cisco IOS is up and running

- If the power supplies and fan trays are operational, but none of the RP LEDs or displays are on, the RP might not be properly installed, or the +5.2 VDC output from the power supply(ies) might be faulty. Turn the rotary power supply switch(es) off, and then loosen the two captive screws at the top and bottom of the RP faceplate; use the ejector levers on the RP to eject it and reseat it. Tighten the two captive screws, and power up the system by turning the rotary power switch(es) to the on (|) position.

- Is a critical, major, or minor alarm LED on the CSC(s) on?
  - — If any one of the three system alarm LEDs is on, a fault has been detected in the system. Check the console for messages indicating the source of the problem.
  - — A false error indication may be originating from the RP. Reseat or replace the RP.

Caution The RP reset switch resets the RP and the entire system. To prevent system errors and problems, use the RP reset switch *only* at the direction of your Cisco-certified service representative.

Troubleshooting the Line Cards

Line cards can be installed in any slot in the upper card cage, except for the two slots in the middle of the card cage, which are reserved for the CSCs. Also, by convention, the left-most slot in the upper card cage is occupied by the RP. However, you need not follow this recommendation.

As each line card powers up in response to a command issued by the RP across the MBus, a power-on self-test (POST) is performed on line card memory. A full set of field diagnostics can also be run on a line card from the system console. The diagnostics provide a pass/fail message in the line card alphanumeric displays, as well as on the system console.

To isolate a problem with a line card, make the following assessment:

- Are both line card alphanumeric displays on?
  - — If both alphanumeric displays are off, the line card may not be fully inserted into the backplane, there may be a problem with the MBus module on the line card, or the system power supply may be off.

    The two line card alphanumeric displays are powered separately. The top display receives power from the DC-DC converter on the line card, and the bottom display receives power from the MBus. Thus, even if the line card has not powered up, the bottom display could be on.
  - — If both displays are on, check the message being displayed. As soon as the DC-DC converter is turned on by the MBus module, the processor on the line card begins the boot process. Status messages appear in the alphanumeric displays as the boot

process continues on the line card. Table 5-3 lists the messages that appear in the line card alphanumeric display. Some messages are displayed for only a few milliseconds, and others are displayed for several seconds.

Table 5-3 Line Card Alphanumeric Display Messages

Top Display	Bottom Display	Message
MEM	TEST	POST memory test running
LROM	RUN	After POST memory test
BSS	INIT	Initialize main memory for ROM
RST	SAVE	Save reset reason register
IO	RST	Reset the I/O system on the card
EXPT	INIT	Initialize interrupt handlers
TLB	INIT	Initialize TLB
CACH	INIT	Initialize CPU data and instruction cache
MEM	INIT	Initialize main memory
LROM	RDY	Ready to access download
ROMI	GET	Getting ROM images
FABL	WAIT	Wait for load of fabric downloader
FABL	DNLD	Loading fabric downloader
FABL	STRT	Launching fabric downloader
FABL	RUN	Fabric downloader launch complete
IOS	DNLD	Downloading the IOS
IOS	STRT	Launching the IOS
IOS	UP	IOS is running
IOS	RUN	Line card enabled

CSC Alarm Functions

The CSC incorporates the following system and component alarm functions:

- Primary system alarm functions—The system's primary alarm LEDs are incorporated into the CSC faceplate (see Figure 3-16). From top to bottom, these LEDs correspond to three levels of severity for system alarm conditions: critical, major, and minor.
- External alarm monitoring facility—The CSC faceplate has a DB-25 connector for the attachment of a site-wide external monitoring system. Such a system can provide both visible and audible alarms.

  A 25-pin D-sub connector on the CSC faceplate is connected directly to the critical, major, and minor alarm relays incorporated into the CSC.

Note Only safety extra-low voltage (SELV) external alarm circuits can be attached to the DB-25 connector on the CSC faceplate.

  A manual reset switch is also incorporated into the CSC faceplate that you can push to reset (silence) an audible alarm. The visible alarm, however, can be reset only by the system's alarm monitoring software.

- Alarm status for other installed components—The CSC provides a visible indication of the status of other cards and components installed in the system. Two LEDs indicate the status of the CSC itself; two side-by-side LEDs indicate the status of the card cage fan tray and the power supply fan tray; finally, two LEDs at the bottom of the CSC faceplate indicate the status of the SFCs installed in the lower card cage.

Check the CSC for an indication of a critical, major, or minor alarm. If any one of the three system alarm LEDs is on, check the system console for messages describing the fault condition.

Troubleshooting the Cooling Subsystem

The Cisco 12008 incorporates two fan trays (see Figure 1-2) that provide cooling air for other system components:

- Card cage fan tray—This fan tray is mounted in the lower card cage behind the air filter assembly.

- Power supply fan tray—This fan tray is mounted in the lower right corner of the router enclosure.

Each fan tray operates from +24 VDC that is distributed to it through the backplane from a DC-DC converter on the CSC. A recessed, blind-mating connector in the back of each fan tray provides connectivity to the backplane.

Both fan trays are essential; they provide sufficient cooling air for the router's components and electronic circuitry. The card cage fan tray incorporates six variable-speed fans; the power supply fan tray incorporates four variable-speed fans.

To isolate a problem with the router's cooling subsystem, make the following assessments:

- When the system is started up, do the fan trays begin to come up to normal rotational after about two seconds?

Note To determine if the fan trays are operating, first listen for the hum of the fans. In a noisy environment, you might have to place your hand at the top rear of the router enclosure to feel the air being exhausted from the fan tray vents.

- — If both fan trays operate as expected, the +24 VDC power from the DC-DC converter on the CSC is confirmed as present and operational.
- — If one fan tray or the other does not operate as expected, there could be a problem with the voltage being supplied to the fan tray. In this case, check the status of the power supply LEDs on the CSC faceplate (see Figure 1-14).

  If the left fan tray LED on the CSC faceplate is on (amber), reseat the card cage fan tray in the backplane, as follows:

  1. Remove the air filter assembly from the chassis.
  2. Loosen the two captive installation screws securing the fan tray to the chassis frame.
  3. Grasp the fan tray carrier by its extraction/insertion ring and pull the unit part way out of the slot.
  4. Firmly reseat the fan tray in the slot.

5. Tighten the fan tray captive installation screws.
6. Reinstall the air filter assembly.

If the left fan tray LED remains on after reseating the card cage fan tray, the unit is faulty and should be replaced.

If the right fan tray LED on the CSC faceplate is on (amber), reseat the power supply fan tray in the backplane, as follows:

1. Loosen the captive installation screw on the fan tray faceplate.
2. Grasp the fan tray by the captive installation screw and partially withdraw the unit from the slot.
3. Firmly reseat the fan tray in the slot.
4. Tighten the fan tray captive installation screw.

If the right fan tray LED remains on after reseating the power supply fan tray, the unit is faulty and should be replaced.

— If a fan tray still fails to operate as expected, a problem may exist with the DC-DC converter on the CSC that powers the fan trays.

On system startup, note that the fans operate at maximum speed until IOS is fully booted or if any fans fail or are absent.

Fan speed is determined by temperature sensors on the cards in the upper and lower card cages and the power supplies. If an air temperature above the normal operating limit is detected within the router, the MBus module on the CSC increases the fan tray operating voltage. This higher voltage results in a corresponding increase in fan speed, forcing more cooling air through the entire router enclosure.

- The following message indicates that the system has detected an overtemperature condition or an out-of-tolerance power condition inside the router:

```
Queued messages:
%ENVM-1-SHUTDOWN: Environmental Monitor initiated shutdown
```

The preceding message could also indicate a faulty component or a faulty temperature sensor. Before the system shuts down, issue the **show environment** command or the **show environment all** command. Either command displays information about the internal system environment, including voltage measurements on each card for the

+3.3 VDC and +5 VDC from the DC-DC converter, the +5.2 VDC for the MBus module, and the operating voltage for the fan trays. Each command also displays the temperature measurements made by two sensors on each card (one for inlet air temperature and one for the card's hot-spot temperature), as well as a temperature measurement made by a sensor in the power supply(ies).

If an environmental shutdown results from an out-of-tolerance power condition, the OUTPUT FAIL LED on the power supply goes on before the system shuts down. In this case, refer to the section entitled "Troubleshooting the Power Subsystem."

— Although an overtemperature condition is unlikely at initial system startup, ensure that heated exhaust air from other equipment in the immediate environment is not entering the air filter assembly; in addition, ensure sufficient clearance — at least 12 inches (30.5 cm) — in the lower front and top rear of the chassis to enable cooling air to freely enter and be expelled from the chassis.

— Check the condition of the air filter. If it appears dirty, remove the filter and clean it, or replace it altogether.

There are no field-replaceable components in the fan trays. If a fan tray is faulty, you must replace the entire unit.

If you are still unable to resolve a problem with the router's cooling subsystem, contact a Cisco service representative for assistance.

Additional Troubleshooting Reference Information

The following additional reference materials are available for troubleshooting your Cisco 12008 installation:

- The various configuration notes for the system's major components
- *Troubleshooting Internetworking Systems*
- *Debug Command Reference*
- *System Error Messages*

CHAPTER 6

Running Diagnostics on the Cisco 12008

Field diagnostics are available for the Cisco 12008 to help you isolate faulty hardware to the level of a field-replaceable unit (FRU) without disrupting the operation of the system. After you identify the faulty unit, you can replace it with a spare unit.

Field diagnostics are not designed to identify specific components within the router. They simply determine whether a particular card is operational or defective.

Running Diagnostics on the Cisco 12008 is presented in the following sections:

Diagnostic Test Overview

There are more than a hundred diagnostic tests for line cards, including the following:

- Processor tests
- Memory tests
- Component tests
- Major data path tests

The field diagnostics software image is bundled with the Cisco IOS software and is downloaded from the route processor (RP) to the target card before testing.

Note When using Cisco IOS Release 12.0(21)S or 12.0(21)ST, or a later release of 12.0S or 12.0ST, the default download method changes from the mbus to the switch fabric. It takes about 1-minute to obtain test results from the switch fabric compared to 15-minutes to obtain test results from the mbus.

While diagnostics are running, the line card being tested is controlled by the diagnostic software. Diagnostics take the line card under test offline. The diagnostics affect just the line card being tested; the rest of the line cards remain online and continue to pass traffic normally.

Except for the tests on the clock and scheduler cards (CSCs) and the switch fabric cards (SFCs), which may temporarily drop throughput on those cards, the diagnostics do not affect system performance.

Diagnostic testing stops at the completion of all of the tests, when terminated by the user, or by default when an error is encountered. If multiple cards are specified for the test cycle, the diagnostics stop testing a card when it fails a test, but continue testing the remaining cards.

Note You can use the **diag** *slot* **coe** command to force the continuation of tests, even after an error is encountered. This is not recommended for use on operational, business-critical routers.

When testing is finished, a pass or fail message displays on the console, as well as on the alphanumeric LED display on the card being tested.

Using the diag Command

The diagnostic test command, issued at the privileged EXEC mode prompt on the system console, takes the following form:

diag *slot* [**halt**] [**previous**] [**mbus**] [**verbose**] [**wait**] [**coe**]

where:

slot	Specifies which card cage slot to test. The diagnostic software determines the type of card in the slot and downloads the appropriate tests.
halt	(Optional) Stops the active diagnostic test.
previous	(Optional) Allows you to examine the last test results on the card, stored in EEPROM, specified by the slot parameter.
mbus[1]	(Optional) Forces the route processor to load diags from the mbus.
verbose	(Optional) Turns on the status messaging capability of the diagnostics. The default is minimum messaging.
wait	(Optional) Stops the diagnostics from reloading the Cisco IOS image following the completion of diagnostic testing. The card must be ejected from the slot, reinstalled in the slot, and reconfigured manually.
coe[2] (Continue on error)	(Optional) Continues testing even after a failed test.

1. Using this option results in a 15-minute delay before test results are returned. This command option is available when using Cisco IOS Release 12.0(21)S or 12.0(21)ST, or a later release of 12.0S or 12.0ST.
2. Not recommended for use on operational, business-critical routers. This command option is available when using Cisco IOS Release 12.0(21)S or 12.0(21)ST, or a later release of 12.0S or 12.0ST.

To stop diagnostic testing at any time, enter the **halt** option in the command, at the privileged EXEC mode prompt on the system console:

diag *slot* **halt**

Diagnostic Testing Sequence

When testing a card, the diagnostics perform the following operations in this sequence:

1. Halts the normal operation of the card.

   The card is no longer available for network traffic.

2 Downloads a diagnostic image from the RPs running IOS software to the line card before testing.

The Cisco IOS software image is removed from the line card DRAM and is replaced with the diagnostic software image for the duration of the tests.

3 Sends and receives messages across the MBus to and from the card being tested.

During the testing process, messages are passed from the line card under test to the RP. If the **verbose** option is turned on, interim messages listing the start and completion of each test are displayed at the console. If the verbose option is not specified (default), the console displays the minimum number of messages.

4 Displays pass or fail test results.

At the conclusion of the diagnostic tests, a pass or fail message is sent to the RP, which passes the message to the console and to the alphanumeric LED display on the line card being tested. The message is displayed on the alphanumeric display until the Cisco IOS image is booted following the completion of testing. The pass or fail message is also stored in Flash memory for later factory analysis.

5 Reloads the Cisco IOS software image.

If diagnostic testing was successful, and you do not specify the **wait** option, the Cisco IOS software image is loaded from the RP to the card under test, bringing it back online.

Loading and Running Diagnostics

Procedures for loading and running diagnostic tests on a card in the router, including sample console display messages, follow. You must run diagnostic tests from the system console in privileged EXEC mode.

To load and run diagnostics on a card, follow these steps:

Step 1 From the EXEC prompt (`Router>`), enter **enable** to enter privileged EXEC mode:

```
Router> enable
Password:
```

Step 2 Enter the password assigned to the system.

The prompt changes to the privileged EXEC prompt:

```
Router#
```

Step 3 Determine the slot number of the card on which you want to run diagnostics.

Note Although you can run diagnostics concurrently on up to three line cards, the recommended number is only one at a time. The cards will be taken offline and cannot pass traffic.

Step 4 Enter the **diag** command:

```
Router# diag slot
```

The diagnostic tests are downloaded and run. Test status and administrative messages are returned to the system console. At the end of testing, a pass or fail message is displayed on the console. The number of messages displayed depends on whether you included the **verbose** option in the command.

Note Field diagnostics run limited tests of the switch fabric when testing a line card. This provides a good method of troubleshooting switch fabric problems.

Diagnostic Examples

Several examples of diagnostic tests are given in the following sections:

- Without verbose Option on page 6
- With verbose Option on page 7
- Failed Diagnostic on page 9

Without verbose Option

To see how the **verbose** option changes the messages from the diagnostics to the console, refer to the following examples.

In the first example, diagnostics are run on a line card installed in slot 2 in the card cage. The diagnostics are run without the **verbose** option set (minimum messaging).

The console displays a message sequence similar to the following, showing the progress of the diagnostic testing. In the following example message sequence, inserted comments describe the type of diagnostic activity by the messages.

```
Router# diag 2
Running DIAG config check
Running Diags will halt ALL activity on the requested slot.
[confirm]
Router# <Return>
Launching a Field Diagnostic for slot 2
Downloading diagnostic tests to slot 2 (timeout set to 400 sec.)
Field Diag download COMPLETE for slot 2
FD 2> *****************************************************
FD 2> GSR Field Diagnostics V3.0
FD 2> Compiled by award on Tue Aug 3 15:58:13 PDT 2000
FD 2> view: award-bfr_112.FieldDiagRelease
FD 2> *****************************************************
FD 2> BFR_CARD_TYPE_OC48_1P_POS_TTM testing...
FD 2> running in slot 2 (73 tests)

Executing all diagnostic tests in slot 2
```

The messages in the lines shown above indicate that the diagnostics software checked the card type and status, determined that the card installed in slot 2 could run diagnostics, downloaded the diagnostic software image to the card, and gave it the command to run all diagnostic tests.

```
(total/indiv. timeout set to 600/220 sec.)
```

The message in the line shown above indicates the two timeout values set for diagnostics. The first timeout is set to 600 seconds, which is the maximum amount of time allowed for all diagnostic tests to run. The second timeout is set to 220 seconds, which is the maximum amount of time allowed for any one diagnostic test to run.

```
Field Diagnostic ****PASSED**** for slot 2
```

The message in the line shown above indicates that the diagnostic tests run on the card in slot 2 all passed.

```
Shutting down diags in slot 2

Board will reload

SLOT 2:%SYS-5-RESTART: System restarted --
Cisco Internetwork Operating System Software
IOS (tm) GS Software (GSR-P-MZ), Released Version 12.0(n)GS
Copyright (c) 1986-2000 by cisco Systems, Inc.
Compiled Fri 17-Sep-00 17:58 by ...
Router#
```

The messages in the lines shown above indicate that the diagnostics software is automatically terminated and the line card is reloaded and restarted.

With verbose Option

If you set the **verbose** option, that changes the diagnostics message stream to the console. As an example, running diagnostics on the line card in slot 2 with the **verbose** option set produces a message stream to the console similar to the following (only a partial list of messages is shown). In the following example message sequence, inserted comments describe the type of diagnostic activity indicated by the messages.

Note In Cisco IOS Release 12.0(21)S or 12.0(21)ST, or a later release of 12.0S or 12.0ST, this option displays the name of the test as testing progresses, and it displays “fatalError” when a failure is detected.

```
Router# diag 2 verbose
Running DIAG config check
Running Diags will halt ALL activity on the requested slot.
[confirm]
Router# <Return>
Launching a Field Diagnostic for slot 2
Downloading diagnostic tests to slot 2 (timeout set to 400 sec.)
Field Diag download COMPLETE for slot 2
```

```
FD 2> ****************************************************
FD 2> GSR Field Diagnostics V3.0
FD 2> Compiled by award on Tue Aug 3 15:58:13 PDT 2000
FD 2> view: award-bfr_112.FieldDiagRelease
FD 2> ****************************************************
FD 2> BFR_CARD_TYPE_OC48_1P_POS_TTM testing...
FD 2> running in slot 2 (73 tests)

Executing all diagnostic tests in slot 2
(total/indiv. timeout set to 600/220 sec.)
FD 2> Verbosity now (0x00000001) TESTSDISP
FDIAG_STAT_IN_PROGRESS: test #1 R5K Internal Cache
FDIAG_STAT_IN_PROGRESS: test #2 Burst Operations
FDIAG_STAT_IN_PROGRESS: test #3 Subblock Ordering
FDIAG_STAT_IN_PROGRESS: test #4 Dram Marching Pattern
FDIAG_STAT_IN_PROGRESS: test #5 Dram Datapins
FDIAG_STAT_IN_PROGRESS: test #6 Dram Busfloat
.
.
.
FDIAG_STAT_IN_PROGRESS: test #73 SDRAM Traffic
FDIAG_STAT_DONE

Field Diagnostic ****PASSED**** for slot 2

Field Diag eeprom values: run 0 fail mode 0 (PASS) slot 2
   last test failed was 0, error code 0
Shutting down diags in slot 2

Board will reload
SLOT 2:%SYS-5-RESTART: System restarted --
Cisco Internetwork Operating System Software
IOS (tm) GS Software (GSR-P-MZ), Released Version 12.0(n)GS
Copyright (c) 1986-2000 by cisco Systems, Inc.
Compiled Fri 17-Sep-00 17:58 by ...
Router#
```

When you set the **verbose** option, most of the information returned by the diagnostic tests is status messages that indicate when tests start and when they are completed. At the end of the diagnostic tests, a message indicates whether the card passed or failed the tests.

Failed Diagnostic

If a diagnostic test fails on a line card, testing halts with that test. The line card will not reload or come back online automatically. The following example shows a diagnostic message stream to the console for a line card located in slot 7. In the example, the card fails one of the diagnostic tests, stopping the diagnostic cycle on that test.

```
Router# diag 7 verbose
Running DIAG config check
Running Diags will halt ALL activity on the requested slot.
[confirm]
Router# <Return>
Launching a Field Diagnostic for slot 7
Downloading diagnostic tests to slot 7 (timeout set to 400 sec.)
Field Diag download COMPLETE for slot 7
FD 7> *****************************************************
FD 7> GSR Field Diagnostics V3.0
FD 7> Compiled by award on Tue Aug 3 15:58:13 PDT 2000
FD 7> view: award-bfr_112.FieldDiagRelease
FD 7> *****************************************************
FD 7> BFR_CARD_TYPE_OC48_1P_POS testing...
FD 7> running in slot 7 (128 tests)

Executing all diagnostic tests in slot 7
(total/indiv. timeout set to 600/220 sec.)
FD 7> Verbosity now (0x00000001) TESTSDISP

FDIAG_STAT_IN_PROGRESS: test #1 R5K Internal Cache
FDIAG_STAT_IN_PROGRESS: test #2 Burst Operations
FDIAG_STAT_IN_PROGRESS: test #3 Subblock Ordering
.
.
.
FDIAG_STAT_IN_PROGRESS: test #21, error_code 5
Field Diagnostic: ****TEST FAILURE**** slot 7: last test run 21,
To Fabric SOP FIFO SRAM Memory, error 5
Field Diag eeprom values:run 0 fail mode 1 (TEST FAILURE) slot 7
   last test failed was 21, error code 5
Shutting down diags in slot 7
slot 7 done, will not reload automatically

Router#
```

Note The DRAM is the only field-replaceable component on a line card; therefore, if a diagnostic test fails, you must replace the line card, which is the field-replaceable unit (FRU).

CHAPTER 7

Maintaining the Cisco 12008

After your Cisco 12008 has been operational for a period of time, you might need to perform specific maintenance tasks, replace certain field replaceable units (FRUs), upgrade memory components, or perform other tasks to ensure that the router continues to operate properly and reliably.

This chapter includes the following sections:

- Cleaning the Air Filter
- Installing and Removing a Blank Filler Panel
- Adding, Removing, or Replacing an AC-Input Power Supply
- Adding, Removing, or Replacing a DC-Input Power Supply
- Removing and Replacing the Fan Trays
- Removing and Replacing the RP
- Removing and Replacing Line Cards
- Removing and Replacing Switch Cards
- Removing and Replacing the Cable Management System
- Upgrading Memory on a Line Card
- Upgrading Memory on the RP

Caution Before performing any of the procedures in this chapter, review the section entitled “Safety Recommendations” in Chapter 2 to prevent problems, damage to equipment, or injury to personnel.

Cleaning the Air Filter

The Cisco 12008 has a removable air filter assembly that forms part of the outer enclosure of the lower card cage (see Figure 7-1). This card cage accommodates a fan tray containing six fans that provide cooling air for all of the router's internal electronic circuitry, including all of the cards installed in the upper card cage slots and the optional set of three SFCs that you can install in the lower card cage slots.

The air filter assembly removes dust and particulate matter from the ambient air being drawn into the router by the card cage fan tray. Once a month (or more often in dusty environments) you should examine the air filter and replace it if it is dirty. You can clean or replace the air filter while the Cisco 12008 remains powered up and fully operational.

A new air filter (product number GSR8-FILTER=) is the only part that you will need if you decide that the old filter needs replacing.

Note When ordering spare air filters, keep in mind that they have a shelf life of approximately 6 months.

To service the air filter, you need only remove the plastic bezel to gain access to the filter proper (see Figure 7-1). A vacuum cleaner is the only tool you need to perform air filter maintenance.

The closure for the lower card cage is designed in a way that permits you to detach the plastic bezel and the air filter without removing the underlying EMI frame. Thus, you can perform filter maintenance without disrupting the EMI integrity of the router enclosure.

The EMI frame, which contains a honeycomb screen for EMI suppression, should remain in place at all times during normal router use to ensure EMI compliance. However, this frame can be removed at any time should it become necessary to access the components in the lower card cage. The EMI frame is secured to the router by means of two panel fasteners (see Figure 7-1).

To remove or replace the air filter, perform the following steps:

Step 1 Using both hands, exert upward pressure on the two lower spring clips (see Figure 7-1) to disengage them from the body of the bezel; swing the bezel upward to release it from the upper spring clips. Set the bezel aside temporarily.

Step 2 Inspect the condition of the air filter and decide if it should be removed and cleaned.

Step 3 To remove the filter, slide it off the two panel fasteners (see Figure 7-1).

Caution Exercise care to prevent damage to the honeycomb screen in the EMI frame. Damage to the honeycomb screen might reduce its EMI suppression characteristics and restrict the flow of cooling air through the router.

Step 4 Vacuum both sides of the filter thoroughly.

Note Do not vacuum the filter without removing it from the EMI frame; also, do not vacuum a removed filter in the proximity of the lower card cage. Either action might dislodge particulate matter that could be drawn into the interior of the router.

If the filter is damaged or cannot be adequately cleaned, discard it and replace it with a new one.

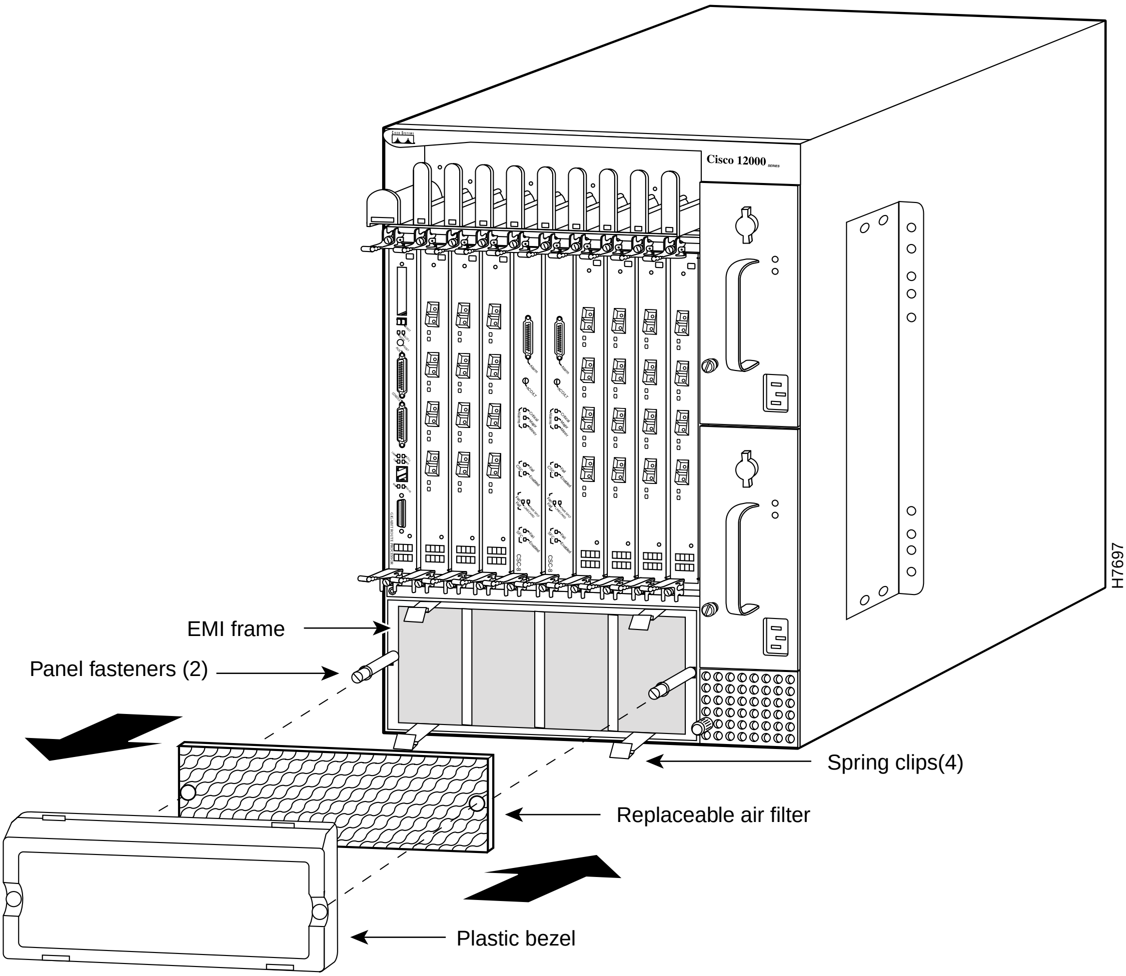
Step 5 As appropriate, reinstall the old filter or install the new filter in the EMI frame; grasp the filter by its sides, position it for insertion over the two panel fasteners, and seat it against the EMI frame.

Step 6 Grasp the plastic bezel by its sides; position the two slots in the lower surface of the bezel over the two lower spring clips of the EMI frame.

Step 7 Rotate the bezel upward, making sure that the two slots in the upper surface of the bezel are properly aligned with the two spring clips at the top of the EMI frame.

Step 8 Exert inward pressure on the bezel to snap it firmly into place.

Figure 7-1 Removing and Replacing the Air Filter Assembly



Installing and Removing a Blank Filler Panel

The Cisco 12008 must be fully enclosed to ensure that cooling air is circulated properly throughout the interior of the router. Fully enclosing the router prevents overheating of electronic components in the upper and lower card cages and suppresses EMI radiation.

To cover any vacant slot in the upper card cage of the Cisco 12008, you must install a blank filler panel (see Figure 7-2).

To install a blank filler panel, perform the following steps:

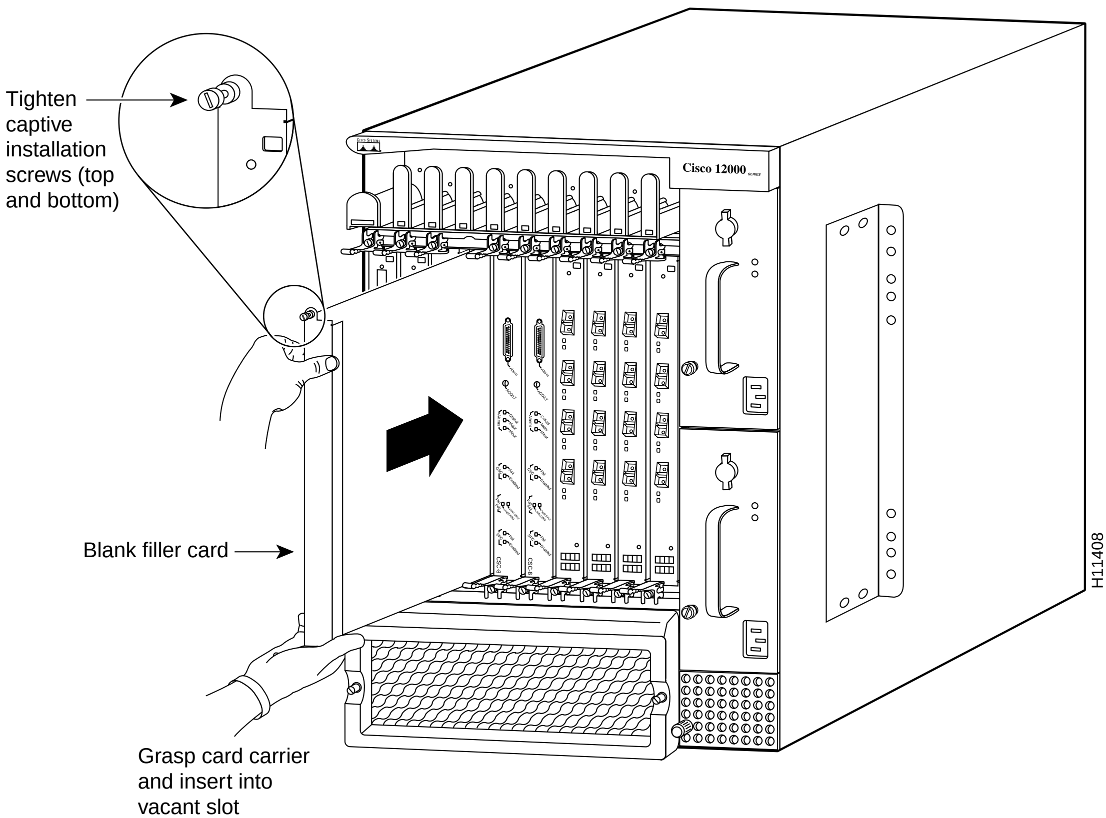
Step 1 Grasp the filler panel and position it vertically for insertion into the vacant slot.

Step 2 Slide the filler panel into the slot until its faceplate is flush against the top and bottom of the card cage.

Step 3 Tighten the captive installation screws on the faceplate of the filler panel to secure it in place.

If you need to install a circuit board in place of the blank filler panel, remove the panel by performing the reverse of the procedure outlined above.

Figure 7-2 Installing a Blank Filler Panel in the Upper Card Cage



Adding, Removing, or Replacing an AC-Input Power Supply

The Cisco 12008 can operate with either one or two AC-input power supplies. Although the router supports an online insertion and removal (OIR) capability for field replaceable units (FRUs), you must observe the following rules regarding the AC-input power supplies:

- If your Cisco 12008 is configured with a single AC-input power supply, you must power down the system before replacing the unit.
- If your Cisco 12008 is configured with two AC-input power supplies, you can remove and replace one of the power supplies while the other unit continues to supply power to the router.

You need the following to add, remove, or replace an AC-input power supply:

- 1/4-inch flat-blade screwdriver (to loosen/tighten the captive installation screw on the power supply faceplate)
- A replacement AC-input power supply and the applicable AC power cord for your site

---

Note To find out which type of AC-input power supply you need for your Cisco 12008, refer to the *Cisco 12008 Gigabit Switch Router AC-Input Power Supply Replacement Instructions* publication.

Caution You cannot use an AC-input power supply and a DC-input power supply in the same chassis.

Adding an AC-Input Power Supply

In the following procedure, it is assumed that you will be adding a second AC-input power supply to the router. In this case, it is also assumed that a blank filler panel has previously been installed in the vacant power supply bay.

Note A vacant power supply bay must always be covered with a blank filler panel to ensure EMI compliance and the proper flow of cooling air through the router.

Note It is recommended that you connect each AC-input power supply to an independent source of power with a 20A service. It is also recommended that you use an uninterruptable power source (UPS) for your site to protect against a site power failure.

To add a second (redundant) AC-input power supply to the router, perform the following steps:

Step 1 Locate the source AC circuit breaker that will service the AC-input power supply; ensure that this circuit breaker is set to the OFF position.

For added safety, tape the circuit breaker handle in the OFF position.

Step 2 Using a 1/4-inch flat-blade screwdriver, loosen the captive installation screw on the blank filler panel covering the vacant (upper) power supply bay; remove the filler panel and retain it for possible future use.

Presumably, you will install the new power supply in the upper power supply bay, since, by convention, a single AC-input power supply is installed in the lower bay.

Step 3 Ensure that the rotary power switch on the faceplate of the new power supply that you intend to install is set to the standby (OFF) position (see Figure 7-3).

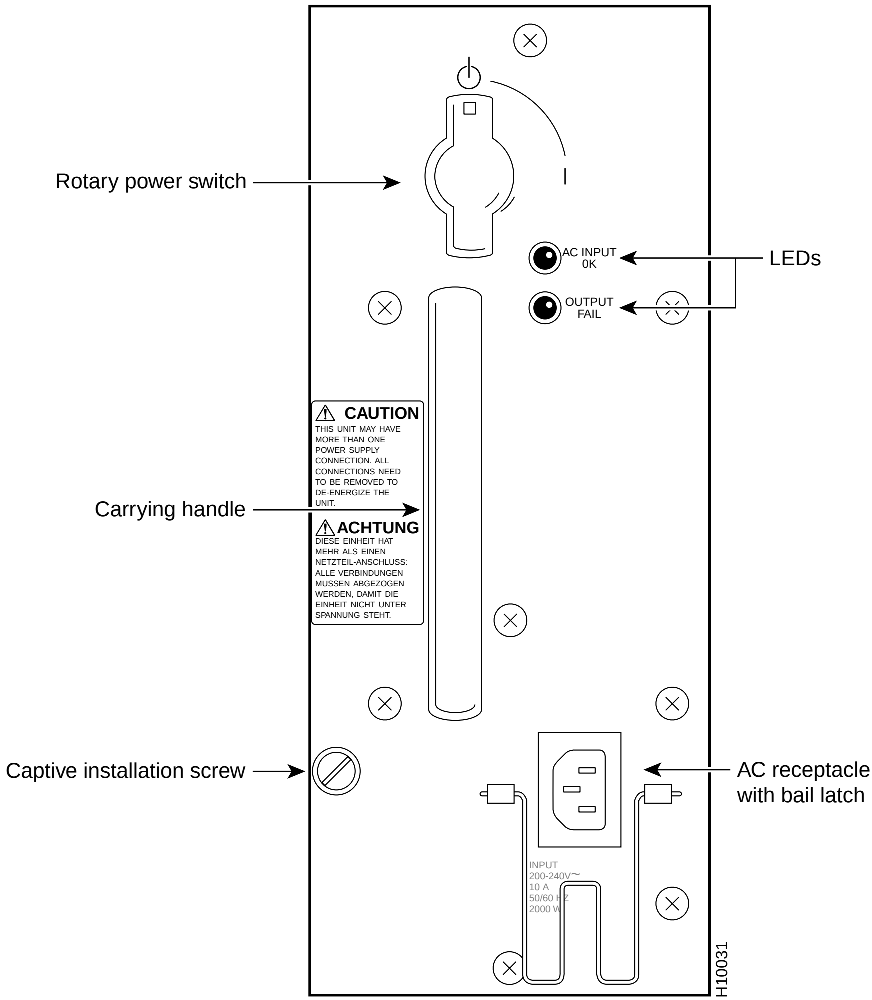
Step 4 Grasp the carrying handle on the new power supply with one hand; while lifting the power supply, place your free hand beneath the unit to support its weight.

Warning The AC-input power supply weighs 17 lb (7.73 kg). For safety, use both hands to install the unit in the power supply bay.

Step 5 Position the power supply appropriately for insertion into the vacant upper bay.

Step 6 Gently slide the unit into the bay, carefully seating it so that the power supply faceplate rests flush against the sheet metal of the power supply bay.

Figure 7-3 Faceplate of the AC-Input Power Supply



Caution To prevent damage to the blind-mating connector at the rear of the power supply, do not use excessive speed or force when inserting the power supply into the bay.

Note All necessary electrical connections between the power supply and the backplane are accomplished automatically by means of the blind-mating connector at the rear of the power supply.

Step 7 Using a 1/4-inch flat-blade screwdriver, tighten the captive installation screw on the faceplate of the power supply (see Figure 7-3).

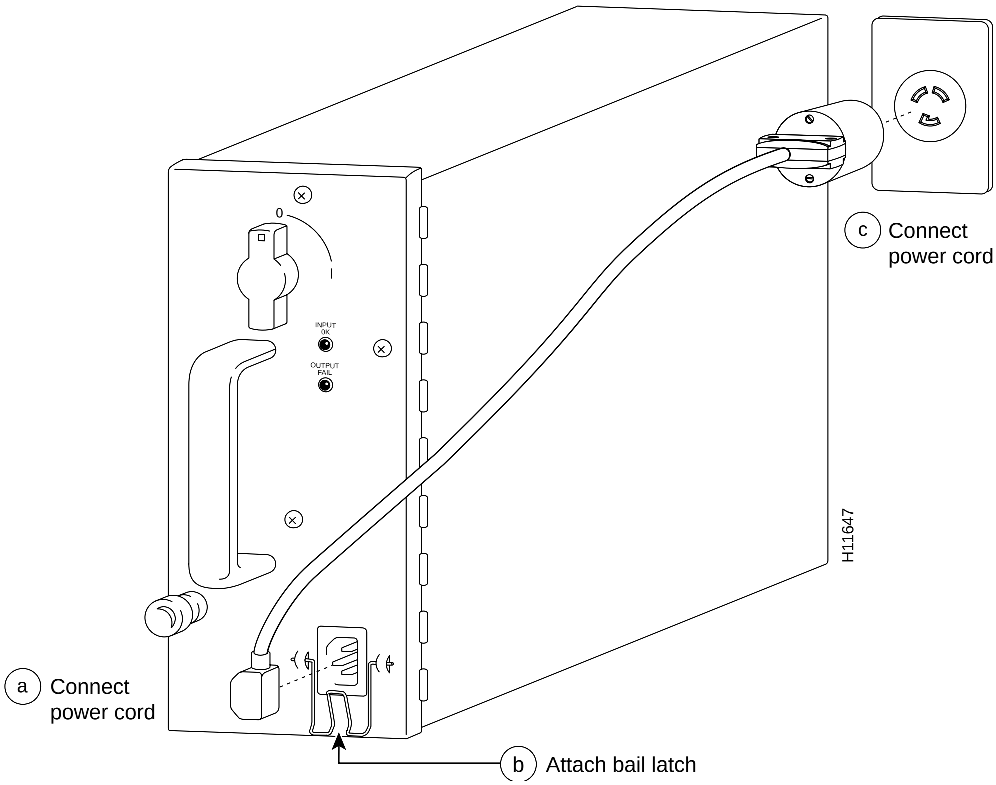
Step 8 Connect the source AC power cord to the AC receptacle on the power supply faceplate (see Figure 7-4a). Secure the bail latch over the source AC power cord (see Figure 7-4b).

Step 9 Connect the other end of the source AC power cord to its power source (see Figure 7-4c).

Step 10 Set the rotary power switch on the new AC-input power supply to the ON (1) position.

To verify that the new AC-input power supply is operating properly, proceed to the section entitled “Verifying the Installation of an AC-Input Power Supply.”

Figure 7-4 Connecting Power to an AC-Input Power Supply



Removing an AC-Input Power Supply

For the following procedure, it is assumed that you will remove an AC-input power supply from a Cisco 12008 that is equipped with a single such unit. In this case, you must power down the router before removing the power supply.

It is also assumed that the power supply to be removed is installed in the lower power supply bay, which, by convention, is the normal configuration for a single power supply. Lastly, in such a single power supply configuration, it is assumed that the upper power supply bay has been previously covered by a blank filler panel to ensure EMI compliance and the proper flow of cooling air through the router.

To remove the AC-input power supply from the router, perform the following steps:

Step 1 Set the rotary power switch on the power supply faceplate to the standby (OFF) position.

Note Turning the power supply switch counterclockwise to the standby (OFF) position also releases the mechanical interlock (latching mechanism) that secures the power supply in the bay.

Step 2 Locate and turn off the source AC circuit breaker that is currently servicing the AC-input power supply.

Step 3 Tape the circuit breaker handle in the OFF position as an added safety precaution.

Step 4 Release the bail latch that secures the source AC power cord to the AC receptacle on the power supply faceplate.

Step 5 Disconnect the source AC power cord from the AC receptacle.

Step 6 Using a flat-blade screwdriver, loosen the captive installation screw on the power supply faceplate that secures the power supply in the bay.

Step 7 With one hand, grasp the power supply carrying handle and pull the unit halfway out of the bay to disengage the female blind-mating connector at the back of the power supply from the backplane.

Warning The AC-input power supply weighs 17 lb (7.73 kg). For safety, use both hands to remove the unit from the power supply bay.

Step 8 Place your free hand beneath the power supply to support its weight and withdraw the unit completely from the bay.

Step 9 Set the power supply aside, pending further disposition.

If you intend to return the removed power supply to the factory for repair or replacement, repackage the unit properly for return shipment using the original packing materials, if available.

Replacing an Existing AC-Input Power Supply

In the following procedure, it is assumed that you will replace an existing power supply in a router that is configured with two (redundant) AC-input power supplies.

In this configuration, the router's online insertion and removal (OIR) capability enables you to replace one of the power supplies without removing power from the other. Thus, the router can remain fully operational during the power supply replacement procedure.

To replace one of the AC-input power supplies in a redundant power supply configuration, perform the following steps:

Step 1 On the power supply to be replaced, set the rotary power switch to the standby (OFF) position.

Note Turning the power supply switch counterclockwise to the standby (OFF) position also releases the mechanical interlock (latching mechanism) that secures the power supply within in the bay.

Step 2 Locate and turn off the source AC circuit breaker that is currently servicing the AC-input power supply.

Step 3 Tape the circuit breaker handle in the OFF position as an added safety precaution.

Step 4 Using a 1/4-inch flat-blade screwdriver, loosen the captive installation screw on the power supply faceplate.

Step 5 Release the bail latch that secures the source AC power cord to the AC receptacle on the power supply faceplate.

Step 6 Remove the power cord from the AC receptacle.

Step 7 Grasp the power supply carrying handle with one hand and pull the unit halfway out of the bay to disengage the blind-mating connector at the back of the power supply from the backplane.

Warning The AC-input power supply weighs 17 lb (7.73 kg). For safety, use both hands to withdraw the unit from the bay.

Step 8 Place your free hand beneath the power supply to support its weight and withdraw the unit completely from the bay.

Step 9 Pending further action, set the unit aside.

If you intend to return the removed power supply to the factory for repair or replacement, repackage the unit properly for return shipment using the original packing materials, if available.

Step 10 On the new AC-input power supply that you intend to install in the now vacant bay, set the rotary power switch on the new power supply to the standby (OFF) position.

Step 11 Grasp the carrying handle on the power supply with one hand; place your free hand beneath the unit to support its weight.

Step 12 Position the unit appropriately for insertion into the power supply bay.

Step 13 Gently slide the new power supply into the bay, carefully seating it so that the power supply faceplate is flush against the sheet metal of the power supply bay. Doing so ensures that the blind-mating connector at the rear of the power supply is firmly seated in the backplane connector.

Caution To prevent damage to the blind-mating connectors, do not use excessive speed or force when inserting the new power supply into the bay.

Note All the necessary electrical connections between the power supply and the backplane are accomplished automatically by means of the blind-mating connectors.

Step 14 Using a 1/4-inch flat-blade screwdriver, tighten the captive installation screw on the power supply faceplate.

Step 15 Connect the source AC power cord to the AC receptacle on the power supply faceplate.

Step 16 Secure the bail latch over the source AC power cord to secure it in the AC receptacle.

Step 17 Set the rotary power switch on the new AC-input power supply to the ON (|) position.

To verify that the new power supply is operating properly, perform the procedure in the following section.

Verifying the Installation of an AC-Input Power Supply

To verify the operation of a newly-installed AC-input power supply, first apply power to the unit and then observe the status of the LEDs on the power supply faceplate.

To verify the operation of a newly-installed AC-input power supply, perform the following steps:

Step 1 First, verify that the following conditions have been satisfied:

- The power supply is completely inserted into the bay and secured in place with its captive installation screw.
- A vacant power supply bay is covered with a blank filler panel to ensure EMI compliance and the proper flow of cooling air through the router enclosure.
- The source AC power cable is properly connected to the AC receptacle on the power supply faceplate.

- The source end of the AC power cable is properly connected to the main source AC circuit breaker.
- The main source AC circuit breaker servicing the AC-input power supply is ON.
- The source AC voltage is within the range specified on the power supply faceplate.
- When two AC-input power supplies are installed, each power cord is connected to a separate AC power source.

  Each AC power source must be on a dedicated circuit rated at 20A (for North America) or 10 or 16A (for the International area).

Step 2 Set the rotary power switch on the newly-installed power supply to the ON position.

Step 3 Observe the behavior of the green AC INPUT OK LED on the power supply faceplate for the following conditions:

- The AC INPUT OK LED illuminates if the source AC voltage is within the proper operating range (see the label on the power supply faceplate).
- If the green AC INPUT OK LED fails to illuminate, determine if
  - (a) The source AC circuit breaker is on.
  - (b) The source AC power cord is securely connected from the source AC circuit breaker to the AC receptacle on the power supply faceplate.
- If the AC INPUT OK LED illuminates as expected, proceed to Step 4.
- If the AC INPUT OK LED fails to illuminate after power is applied to the unit, contact a Cisco service representative for assistance.

Step 4 Observe the behavior of the red OUTPUT FAIL LED on the power supply faceplate after you apply power to the unit. This LED should flash on momentarily, then go off and remain so.

- If the OUTPUT FAIL LED behaves as expected, proceed with normal system operations.
- If the OUTPUT FAIL LED remains on when the new power supply is installed and powered up, the power supply may be faulty, or an adverse environmental condition may exist in the router, such as an overvoltage or overtemperature condition that causes the power supply to shut down.
- If two AC-input power supplies are installed and the OUTPUT FAIL LED illuminates on only one power supply, the associated power supply itself may be faulty, or source power for that unit may be faulty.
- If the OUTPUT FAIL LEDs on both power supplies go on, each of which is connected to a separate AC power source, you can assume that an overvoltage or overtemperature condition in the router is causing both power supplies to fail. Also, the OUTPUT FAIL LEDs could be on due to a defective MBus controller or an old version of MBus code.

If the new AC-input power supply fails to operate properly after several attempts to power it up as described above, contact your Cisco service representative for assistance.

Adding, Removing, or Replacing a DC-Input Power Supply

The Cisco 12008 can operate with either one or two DC-input power supplies. Although the router supports an online insertion and removal (OIR) capability for field replaceable units (FRUs), you must observe the following rules regarding the DC-input power supplies:

- If your Cisco 12008 is configured with a single DC-input power supply, you must power down the system before replacing the unit.
- If your Cisco 12008 is configured with two DC-input power supplies, you can remove and replace one of the power supplies while the other unit remains operational.

To add, remove, or replace a DC-input power supply, you need the following tools:

- A 1/4-inch flat-blade screwdriver (to loosen/tighten the captive installation screw on the power supply faceplate).
- A 10 mm, hollow-shaft nutdriver (to secure the source DC power cables to the terminals on the power supply with the lock washers and nuts). A 1/4-inch socket wrench with a 10 mm deep-well socket will also suffice for this purpose.
- A voltmeter (to test the voltages across the source DC power cables).

The replacement DC-input power supply (product number PWR-GSR8-DC=) is the only part that you will need during the following procedures.

Caution You cannot use an AC-input power supply and a DC-input power supply in the same chassis.

Adding a DC-Input Power Supply

In the following procedure, it is assumed that you will be adding a second DC-input power supply to the router. It is also assumed that a blank filler panel is installed in the vacant power supply bay.

Note A vacant power supply bay must always be covered with a blank filler panel to ensure EMI compliance and the proper flow of cooling air through the router.

Warning Before attempting to install a redundant DC-input power supply, you must have a second, independent DC power source available to service the unit.

To install a second (redundant) DC-input power supply, you must first satisfy the following requirements:

- Ensure that a dedicated 40A service is available for the second power supply.
- Ensure that the power cables from the source DC service circuit breaker to the DC-input power supply are made of 4 AWG, high-strand-count copper wire.
- Ensure that the lugs on the source DC power cables (see Figure 7-5) have dual-holes, centered 0.625 inch apart, and that they will fit over the 0.25-inch M6 (metric) threaded terminals on the DC power supply faceplate (see Figure 7-6).

Caution AC-input and DC-input power supplies cannot be used together in the same router. Such a configuration is not supported and may damage the system.

Note If you are adding a second (redundant) DC-input power supply to your router, you will need to obtain the proper source DC power cables and terminal lugs from a commercial supplier in order to connect source DC power to the new DC-input power supply. These parts are not available from Cisco Systems.

Figure 7-5 Dimensions of the Lugs Used with the Source DC Power Cables

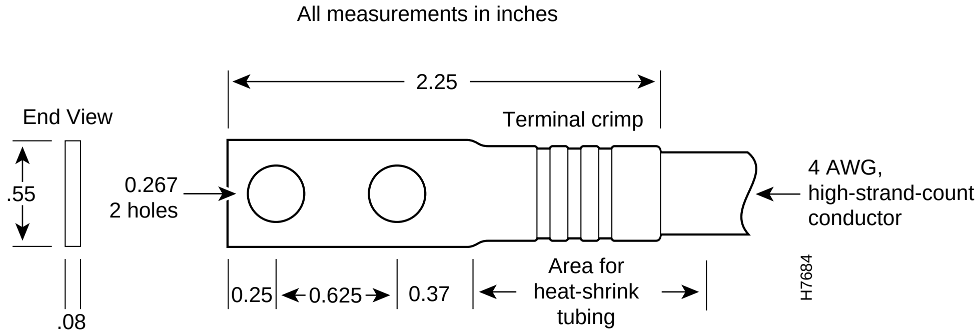
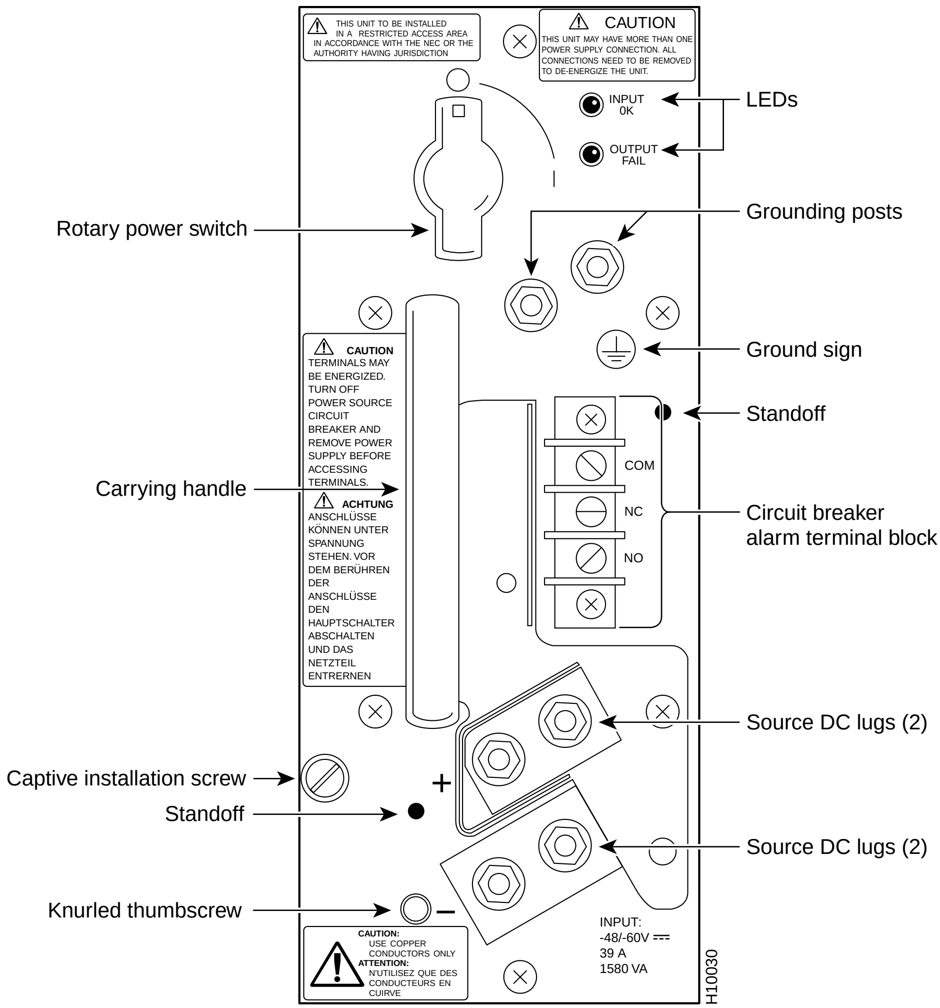


Figure 7-6 Faceplate of the DC-Input Power Supply



To add a second (redundant) DC-input power supply to the router, perform the following steps:

Step 1 Locate the source DC circuit breaker that will service the DC-input power supply; ensure that this circuit breaker is set to the OFF position. For added safety, tape the circuit breaker handle in the OFF position.

Note The color coding scheme used for the source DC power cables for the DC-input power supply depends on the scheme used for the site DC power source. Typically, green or green/yellow is used for earth ground, red is used for positive (+), and black is used for negative (–). Make certain that you properly map the color coding scheme used at the site for the DC power source to the proper terminals on the DC-input power supply faceplate.

Warning To be completely sure that power has been removed from the source DC circuit that will be used to service the new power supply, use a voltmeter to measure the voltage across the negative (–) and positive (+) source DC leads to be connected to the power supply. Set the voltmeter to a range that makes it capable of measuring up to 75 VDC. The measurement across the positive and negative leads should be zero (0) volts.

Step 2 Using a 1/4-inch flat-blade screwdriver, loosen the captive installation screw on the blank filler panel covering the vacant (upper) power supply bay; remove the filler panel and retain it for possible future use.

Presumably, you will be installing the new power supply in the upper power supply bay, since, by convention, a single DC-input power supply is installed in the lower bay.

Step 3 Ensure that the rotary power switch on the faceplate of the new power supply that you will be installing is set to the OFF (O) position.

Step 4 Grasp the carrying handle on the new power supply with your left hand; while lifting the power supply, place your right hand beneath the unit to support its weight.

Note The carrying handle on the DC-input power supply is designed to be grasped with your left hand, rather than your right hand. Using your left hand eliminates the potential for catching your fingers in the limited space between the plastic safety shield (see Figure 7-7) and the carrying handle.

Warning The DC-input power supply weighs 14 lb (6.36 kg). For safety, use both hands to install the unit in the power supply bay.

Step 5 Position the power supply appropriately for insertion into the vacant upper bay.

Step 6 Gently slide the unit into the bay, carefully seating it so that the power supply faceplate rests flush against the sheet metal of the power supply bay.

Caution To prevent damage to the blind-mating connector at the rear of the power supply, do not use excessive speed or force when inserting the power supply into the bay.

Note All necessary electrical connections between the power supply and the backplane are accomplished automatically by means of the blind-mating connector at the rear of the power supply.

Step 7 Using a 1/4-inch flat-blade screwdriver, tighten the captive installation screw on the power supply faceplate (see Figure 7-6).

Step 8 Remove the plastic safety shield (see Figure 7-7) that covers the alarm terminal block and the positive (+) and negative (–) terminals on the power supply faceplate.

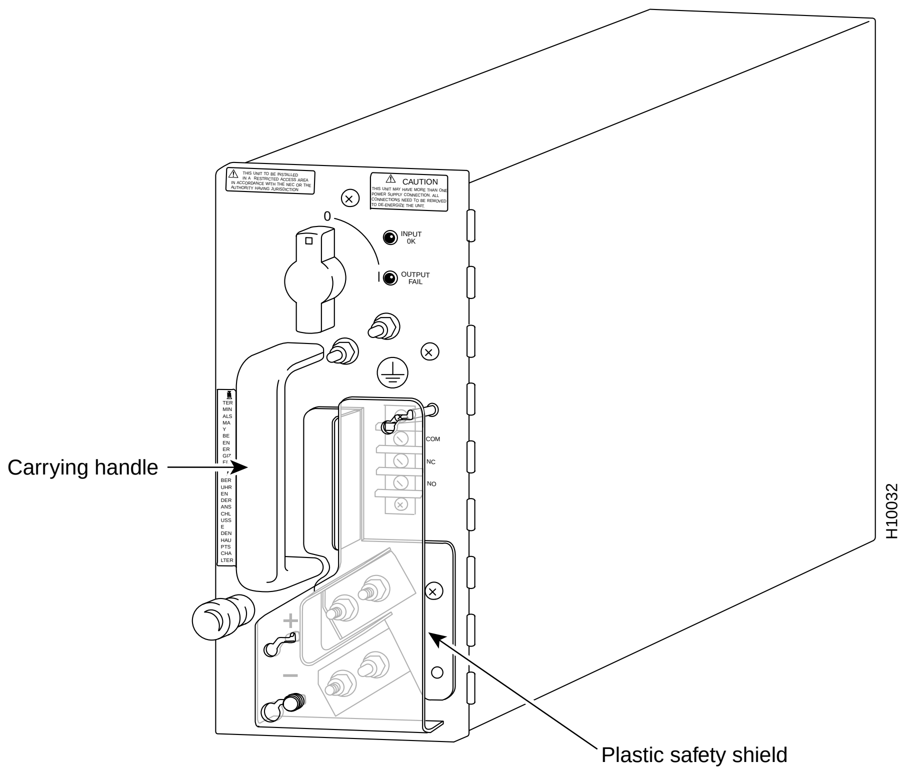
To remove the plastic safety shield, take the following actions:

(a) Loosen the knurled thumb wheel on the bottom left standoff that secures the safety shield to the power supply faceplate.

(b) Grasp the safety shield and move it to the right and obliquely upward, positioning the shield so that it can be freed from the three standoffs on the power supply faceplate.

(c) Remove the shield from the standoffs and set it aside temporarily.

Figure 7-7 Plastic Safety Shield on the DC-Input Power Supply



Step 9 Unscrew the loosely mounted lock washers and nuts from all six terminals on the power supply faceplate; set this hardware aside temporarily.

Step 10 As an added safety precaution, it is recommended that you add a length of shrink tubing to the crimp area on each power cable lug (see Figure 7-5) before connecting the leads to the power supply.

The shrink tubing acts as an insulator to prevent the crimp area on the source DC power cable lugs from coming in contact with the faceplate of the DC-input power supply.

Step 11 Connect the source DC power leads to the terminals on the power supply faceplate. In so doing, strictly observe the following order in connecting the leads to the power supply:

(a) Ground

(b) + (positive)

(c) **–** (negative)

Step 12 Using the lock washers and nuts removed from the terminals in Step 9, connect each power supply cable to the appropriate terminals on the power supply faceplate.

Observe the order shown in Figure 7-8 in connecting the source DC power cables to the terminals on the power supply.

Step 13 After installing each cable, securely tighten the associated lock washers and nuts on the power supply terminals using a 10 mm nutdriver (or a 1/4-inch socket wrench with a 10 mm deep-well socket).

Caution Do not overtighten the nuts on the power supply terminals.

Step 14 If you intend to attach an external alarm monitoring facility to the alarm terminal block on the power supply, connect the leads from the external monitoring facility to the circuit breaker alarm terminal block. Figure 7-9 shows an example of how these leads can be connected.

Note The circuit breaker alarm terminal block enables you to attach an external monitoring facility to the power supply to detect when the power supply circuit breaker trips during an electrical event, such as an overvoltage condition in the power supply.

The functions and uses of the circuit breaker alarm terminal block are described in detail in the subsection entitled "Circuit Breaker Alarm Terminal Block" in Chapter 1.

Figure 7-8 Connecting Source DC Power Cables to the DC-Input Power Supply

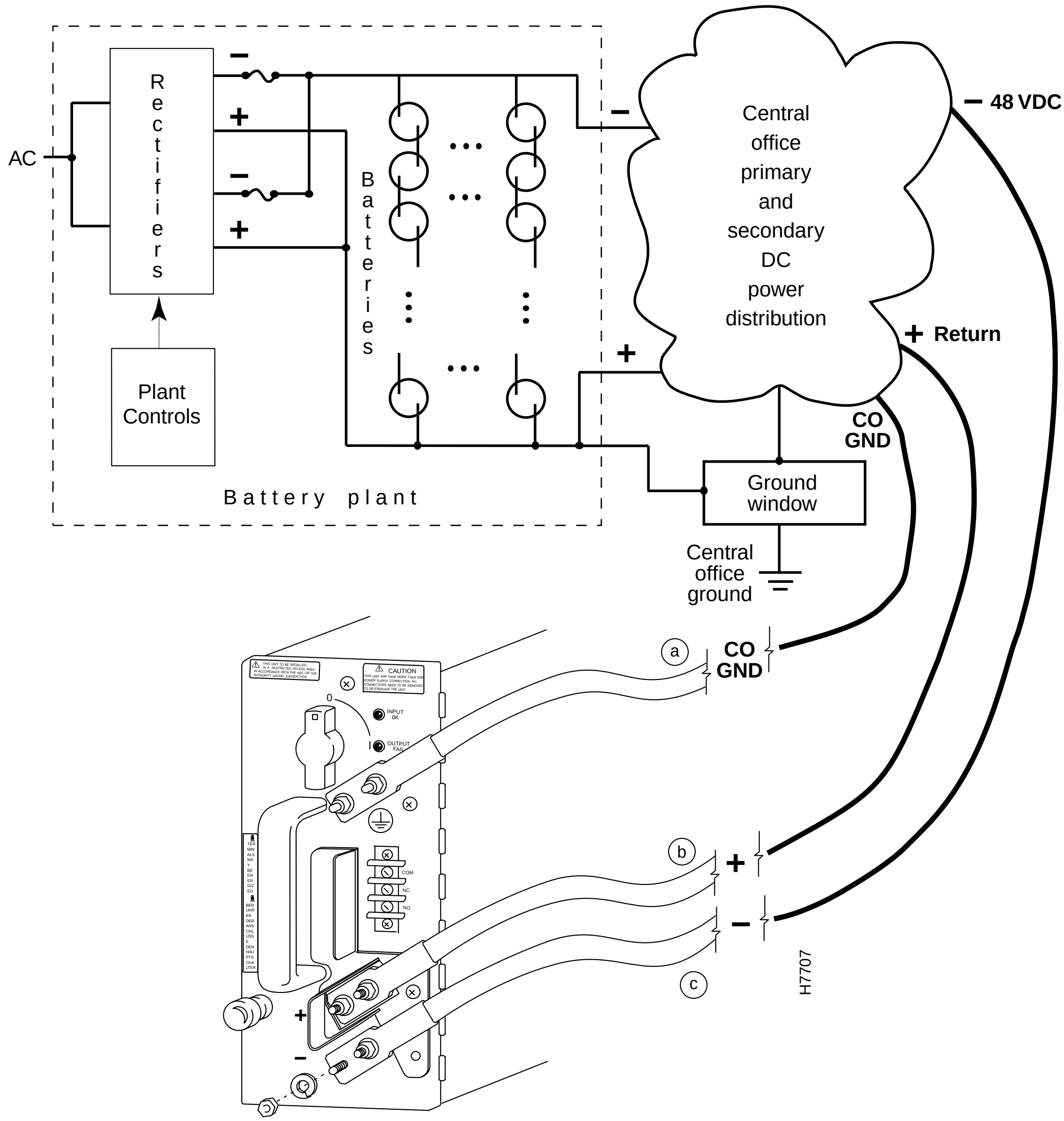
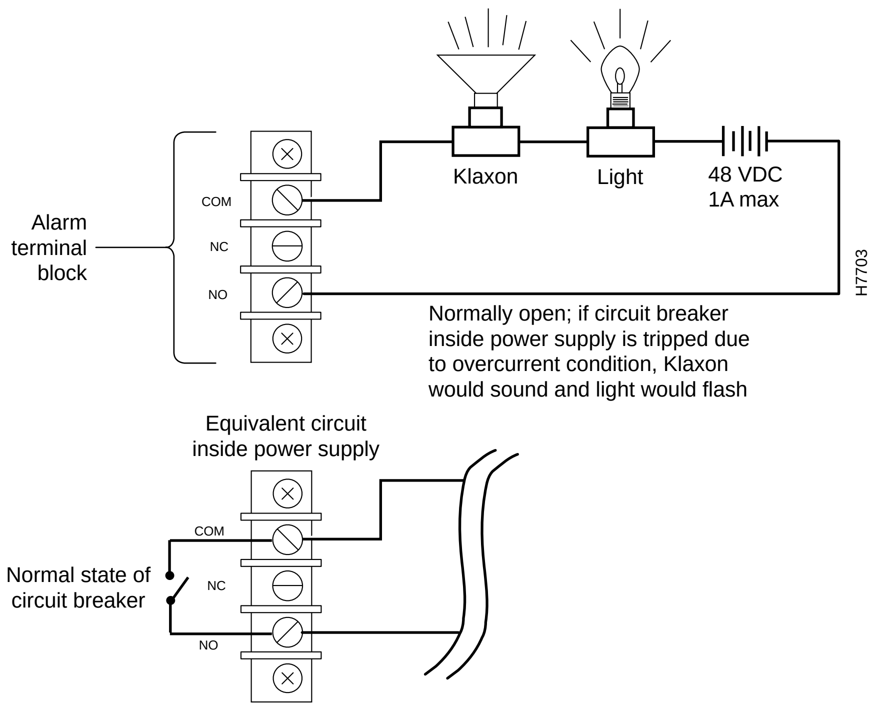


Figure 7-9 Connecting Leads to the Circuit Breaker Alarm Terminal Block



Step 15 Reinstall the plastic safety shield (see Figure 7-7) on the power supply faceplate by taking the following actions:

(a) Seat the shield over the standoffs on the power supply faceplate.

(b) Move the shield to the left and obliquely downward so that it registers properly on the three standoffs on the power supply faceplate.

(c) Tighten the knurled thumbscrew on the bottom left standoff to secure the shield to the power supply faceplate.

Step 16 Remove the tape from the main circuit breaker supplying source power to the new power supply (see Step 1).

Step 17 Set the circuit breaker to the ON position.

Step 18 Set the rotary power switch on the new DC-input power supply to the ON (|) position.

To verify that the new DC-input power supply is operating properly, proceed to the section below entitled “Verifying the Installation of a DC-Input Power Supply.”

Removing a DC-Input Power Supply

For the following procedure, it is assumed that you will be removing a DC-input power supply from a Cisco 12008 router that is equipped with a single such unit. In this case, you must power down the router before removing the power supply.

It is assumed further that the power supply to be removed is installed in the lower power supply bay, which, by convention, is the recommended bay for installing a single power supply.

To remove the DC-input power supply from the router, perform the following steps:

Step 1 Set the rotary power switch on the power supply faceplate to the OFF (O) position.

Note Turning the power supply switch counterclockwise to the OFF (O) position also releases the mechanical interlock (latching mechanism) that secures the power supply in the bay.

Step 2 Locate and turn off the source DC circuit breaker that is servicing the DC-input power supply.

Step 3 Tape the circuit breaker handle in the OFF position as an added safety precaution.

Step 4 Remove the plastic safety shield (see Figure 7-7) that covers the alarm terminal block and the positive (+) and negative (–) terminals on the power supply faceplate.

To remove the plastic safety shield (see Figure 7-7), take the following actions:

(a) Loosen the knurled thumb wheel on the bottom left standoff that secures the safety shield to the power supply faceplate.

(b) Grasp the safety shield and move it to the right and obliquely upward, positioning the shield so that it can be freed from the three standoffs on the power supply faceplate.

(c) Remove the shield from the standoffs and set it aside temporarily.

Warning To be completely sure that power has been removed from the source DC circuit that is presently servicing the power supply, use a voltmeter to measure the voltage across the negative (–) and positive (+) source DC leads on the power supply. Set the voltmeter to a range that makes it capable of measuring up to 75 VDC. The measurement across the positive and negative leads should be zero (0) volts.

Step 5 Before removing the power cables, write the name of each cable on a piece of tape, as follows:

- Ground
- + (positive)
- **–** (negative)

Step 6 Attach each piece of tape to the appropriate cable to identify it for later reconnection.

Step 7 Remove the power cables from the power supply terminals; strictly observe the following order in removing the cables:

(a) **–** (negative)

(b) + positive)

(c) Ground

Step 8 Using a 10 mm nutdriver (or a 1/4-inch socket wrench with a 10 mm deep-well socket) loosen the nuts securing the negative (–) power cable to the bottom terminals on the power supply faceplate; remove the nuts and locking washers from the terminals and set this hardware aside temporarily.

Step 9 Proceed in like manner to remove the remaining power cables from the positive (+) terminals and the grounding terminals, making sure that you remove the earth ground cable last.

Step 10 For added safety, place tape over the exposed lugs of the power cables to prevent contact between the leads.

Step 11 If leads are attached to the circuit breaker alarm terminal block on the power supply faceplate (see Figure 7-9), make a note of how these leads are connected so that they can be properly reconnected later.

Step 12 Using a 1/4-inch flat-blade screwdriver, loosen the captive installation screw on the power supply faceplate (see Figure 7-6).

Step 13 Grasp the power supply carrying handle with your left hand and pull the unit halfway out of the bay to disengage the blind-mating connector at the back of the power supply from the backplane.

Warning The DC-input power supply weighs 14 lb (6.36 kg). For safety, use both hands to remove the unit from the power supply bay.

Step 14 Place your right hand beneath the power supply to support its weight; withdraw the unit completely from the bay.

Step 15 Set the power supply aside in a safe place, pending further disposition.

If you intend to return the removed power supply to the factory for repair or replacement, repackage the unit properly for return shipment using the original packing materials, if available.

Replacing a DC-Input Power Supply

In the following procedure, it is assumed that you will be replacing an existing power supply in a router containing redundant DC-input power supplies. In this configuration, the router's online insertion and removal (OIR) capability enables you to replace a given power supply without removing power from the router.

To replace a power supply in a redundant DC-input power supply configuration, perform the following steps:

Step 1 Set the rotary power switch on the faceplate of the power supply to be removed to the OFF (O) position.

Note Turning the power supply switch to the OFF (O) position also releases the mechanical interlock (latching mechanism) that secures the power supply in the bay.

Step 2 Locate and turn off the source DC circuit breaker that is currently servicing the DC-input power supply.

Step 3 Tape the circuit breaker handle in the OFF position as an additional safety precaution.

Step 4 Remove the plastic safety shield (see Figure 7-7) that covers the alarm terminal block and the positive (+) and negative (–) terminals on the power supply faceplate.

To remove the plastic safety shield, take the following actions:

(a) Loosen the knurled thumb wheel on the bottom left standoff that secures the safety shield to the power supply faceplate.

(b) Grasp the safety shield and move it to the right and obliquely upward, positioning the shield so that it can be freed from the three standoffs on the power supply faceplate.

(c) Remove the shield from the standoffs and set it aside temporarily.

Warning To be completely sure that power has been removed from the source DC circuit presently servicing the power supply that you intend to remove, use a voltmeter to measure the voltage across the negative (–) and positive (+) source DC leads. Set the voltmeter to a range that makes it capable of measuring up to 75 VDC. The measurement across the positive and negative leads should be zero (0) volts.

Step 5 Before removing the power cables, write the name of each cable on a piece of tape, as follows:

- Ground
- + (positive)
- **–** (negative)

Step 6 Attach each piece of tape to the appropriate cable to identify it for later reconnection.

Step 7 Remove the power cables from the power supply terminals, strictly observing the following order of removal:

(a) **–** (negative)

(b) + (positive)

(c) Ground

Step 8 Using a 10 mm nutdriver (or a 1/4-inch socket wrench with a 10 mm deep-well socket), loosen the nuts securing the negative (–) power cable to the bottom terminals on the power supply faceplate; remove the nuts and locking washers from the terminals; set this hardware aside temporarily and remove the power cable from the negative terminals.

Step 9 Proceed in like manner to remove the positive (+) and grounding cables from the power supply terminals, making sure that you remove the ground cable last.

Step 10 For added safety, place tape over the exposed lugs of the power cables to prevent contact between the leads.

Step 11 If an external alarm monitoring facility is attached to the circuit breaker alarm terminal block on the power supply faceplate (see Figure 7-9), make a note of how the leads are connected. Doing so enables you to properly identify each lead for later reconnection.

Step 12 Disconnect the leads from the circuit breaker alarm terminal block.

Step 13 Using a 1/4-inch flat-blade screwdriver, loosen the captive installation screw on the power supply faceplate (see Figure 7-6).

Step 14 Grasp the power supply carrying handle with your left hand and pull the unit halfway out of the bay to disengage the blind-mating connector at the back of the power supply from the backplane.

Warning The DC-input power supply weighs 14 lb (6.36 kg). For safety, use both hands to withdraw the unit from the bay.

Step 15 Place your right hand beneath the power supply to support its weight and completely withdraw the unit from the bay.

Step 16 Pending further action, set the unit aside in a safe place.

If you intend to return the removed power supply to the factory for repair or replacement, restore the nuts and lock washers to the power supply terminals, and reinstall the plastic safety shield (see Figure 7-7) on the faceplate standoffs. Repackage the unit properly for return shipment using the original packing materials, if available.

Step 17 On the new DC-input power supply that you intend to install in the now vacant power supply bay, set the rotary power switch on the power supply faceplate to the OFF (0) position.

Step 18 Grasp the carrying handle on the power supply with one hand; place your free hand beneath the unit to support its weight.

Step 19 Position the unit appropriately for insertion into the power supply bay.

Step 20 Gently slide the new power supply into the vacant bay, carefully seating it so that the power supply faceplate is flush against the sheet metal of the power supply bay. This action ensures that the blind-mating connector at the rear of the power supply is firmly seated into the backplane connector.

Caution To prevent damage to the blind-mating connectors, do not use excessive speed or force when inserting the new power supply into the bay.

Note All the necessary electrical connections between the power supply and the backplane are accomplished automatically by means of the blind-mating connectors.

Step 21 Using a 1/4-inch flat-blade screwdriver, tighten the captive installation screw on the power supply faceplate.

Step 22 Remove the plastic safety shield (see Figure 7-7) from the new power supply, taking the same actions as specified in Step 4 above.

Warning To be completely sure that power has been removed from the source DC circuit that you intend to reconnect to the new power supply, use a voltmeter to measure the voltage across the negative (–) and positive (+) source DC leads. Set the voltmeter to a range that makes it capable of measuring up to 75 VDC. The measurement across the negative and positive leads should be zero (0) volts.

Step 23 Unscrew the loosely mounted lock washers and nuts from all six terminals on the new power supply faceplate; set this hardware aside temporarily.

Step 24 Before connecting each cable to the appropriate terminals on the power supply faceplate, remove the tape (that you applied in Step 10 above) from the lug. Strictly observe the following order in reconnecting the leads to the power supply terminals:

(a) Ground

(b) + (positive)

(c) – (negative)

Step 25 Secure each cable to the terminals using the previously removed lock washers and nuts. Tighten the lock washers and nuts on each terminal using a 10 mm nutdriver (or a 1/4-inch socket wrench with a 10 mm deep-well socket).

Caution Do not overtighten the nuts on the power supply terminals.

Step 26 If you intend to reconnect the external alarm monitoring facility to the circuit breaker alarm terminal block on the new power supply, reconnect the leads as they were on the old power supply (see Step 11).

Step 27 Remove the tape securing the main source DC circuit breaker in the OFF (0) position (see Step 3).

Step 28 Set the main source DC circuit breaker to the ON (1) position.

Step 29 Set the rotary power switch on the new DC-input power supply to the ON (|) position.

To verify that the new DC-input power supply is operating properly, perform the procedure in the following section.

Verifying the Installation of a DC-Input Power Supply

To verify the operation of a newly-installed DC-input power supply, first apply power to the unit and observe the status of the LEDs on the power supply faceplate.

To verify the operation of a newly-installed DC-input power supply, perform the following steps:

Step 1 First, verify that the following conditions are satisfied:

- The power supply is completely inserted into the bay and secured in place with the captive installation screw.
- A vacant power supply bay is covered with a blank filler panel.
- The source DC power cables are connected properly to the terminals on the power supply faceplate.
- The source end of the DC power cable is properly connected to the main source DC circuit breaker.
- The main source DC circuit breaker servicing the DC-input power supply is in the ON (|) position.
- The source DC voltage is within the range indicated on the power supply faceplate.
- If two DC-input power supplies are installed, each power supply is being serviced by a separate 40A DC power source.

Step 2 Assuming that you have not already done so, set the rotary power switch of the newly installed power supply to the ON position.

Step 3 Observe the behavior of the green INPUT OK LED on the power supply faceplate for the following conditions:

- If the source DC voltage is within the proper range, the INPUT OK LED goes on.
- If the green INPUT OK LED does not go on, determine if
  (a) The main source DC circuit breaker is on.
  (b) The source DC power cables are connected properly to the terminals on the power supply faceplate.

- If the INPUT OK LED goes on, proceed to Step 4.
- If the INPUT OK LED does not go on after you apply power to the unit and verify the conditions outlined in Step 1, contact your local Cisco service representative for assistance.

Step 4 Observe the behavior of the red OUTPUT FAIL LED on the power supply faceplate after applying power to the unit. This LED should flash on momentarily, then go off and remain so.

- If the OUTPUT FAIL LED on the new power supply behaves as expected, proceed with normal system operations.
- If the OUTPUT FAIL LED remains on when the new power supply is installed and powered up, the power supply may be faulty, or an adverse environmental condition may exist in the router, such as an overvoltage or overtemperature condition that causes the power supply to shut down.
- If two power supplies are installed and the OUTPUT FAIL LED on only one power supply goes on, you can assume that the power supply itself is faulty, or that the DC source for that power supply is faulty.
- If the OUTPUT FAIL LEDs on both power supplies go on, each of which is connected to a separate DC power source, you can assume that an overvoltage or overtemperature condition in the router is causing both power supplies to fail. Also, the OUTPUT FAIL LEDs could be on due to a defective MBus controller or an old version of MBus code.

If the new DC-input power supply fails to operate properly after several attempts to power it up as described above, contact your Cisco service representative for assistance.

Removing and Replacing the Fan Trays

This section presents the procedures for removing and installing the following fan trays incorporated into the Cisco 12008:

- Card cage fan tray—Located in the lower card cage behind the air filter assembly
- Power supply fan tray—Located in the lower right corner of the router enclosure

The Cisco 12008 supports online insertion and removal of field-replaceable units (FRUs); thus, you can remove and replace a fan tray while the rest of the system remains powered up and fully operational.

Note If you replace a defective fan tray while the router is running, you must do so quickly to minimize the risk of overheating router components. The system shuts down approximately 2 minutes after reaching the shutdown temperature threshold; therefore, you should replace a defective fan tray within this time span.

You will need the following tools and parts to remove or install a fan tray:

- 1/4-inch flat-blade screwdriver
- ESD-preventive wrist strap
- Lower card cage fan tray—product number GSR8-SYSBLOWER=
- Power supply fan tray—product number GSR8-PWRBLOWER=

Removing the Fan Tray from the Lower Card Cage

To remove the fan tray from the lower card cage, perform the following steps.

Step 1 Loosen the two panel fastener screws on each side of the air filter assembly (see Figure 7-10); remove the assembly to expose the interior of the lower card cage and set it aside.

Step 2 Loosen the two captive installation screws at the sides of the fan tray.

Step 3 With one hand, grasp the ring-shaped insertion/extraction tab in the middle of the fan tray carrier; gently slide the fan tray halfway out of the guide rails to disengage the fan tray connector from the backplane (see Figure 7-10).

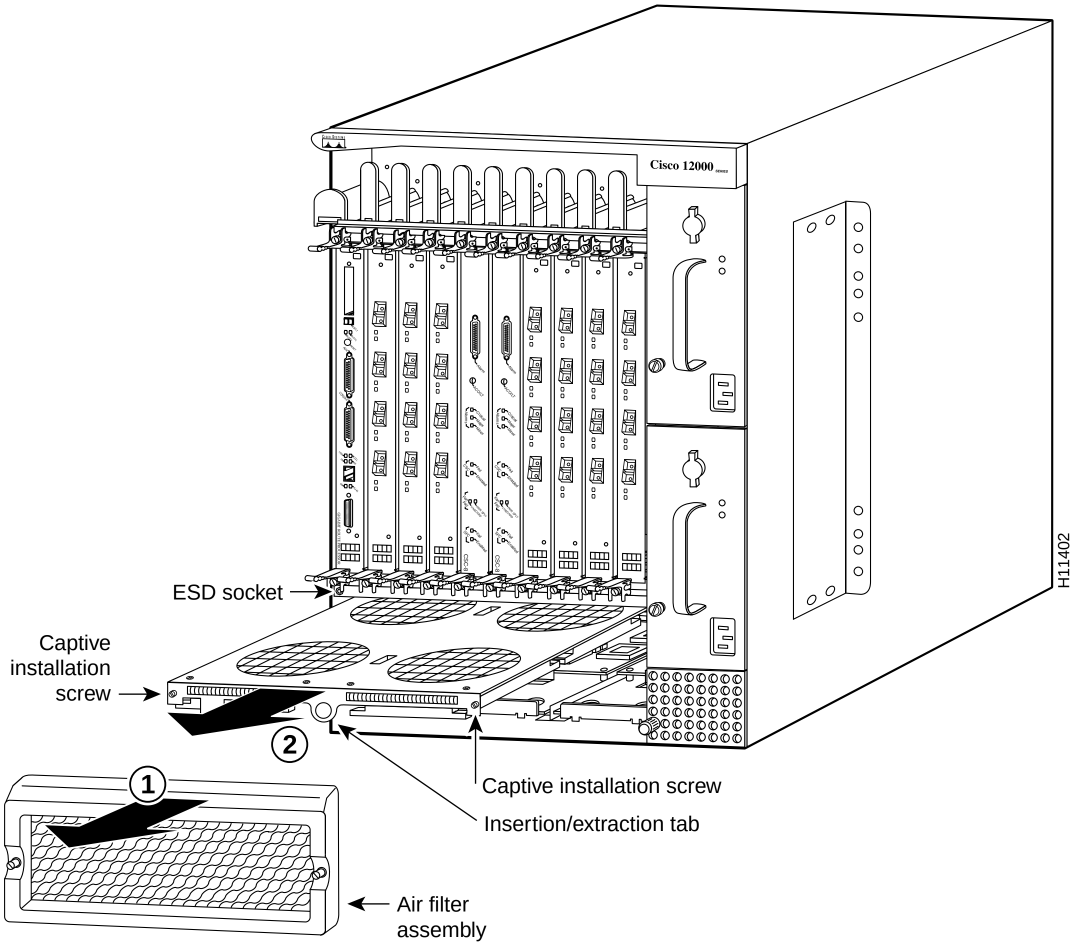
Step 4 Place your free hand beneath the fan tray to support its weight and slide the module completely out of the card cage.

Step 5 Set the fan tray aside.

Caution The card cage fan tray weighs approximately 12 lb (5.45 kg). For safety, use both hands when handling this assembly.

If you plan to return the removed fan tray to the factory for repair or replacement, repackage the unit in the original shipping container, if available, and prepare the package for return shipment.

Figure 7-10 Removing the Card Cage Fan Tray from the Router



Installing a Fan Tray in the Lower Card Cage

For the following procedure, it is assumed that you have removed a defective fan tray from the lower card cage and that you intend to replace it with a new one.

To install a new fan tray in the lower card cage, perform the following steps.

Caution For safety, use both hands when handling the card cage fan tray.

Step 1 With one hand, grasp the ring-shaped insertion/extraction tab in the middle of the new fan tray carrier and raise the front end of the assembly.

Step 2 Place your free hand beneath the assembly to support its weight; position the assembly in front of the guide rails in the lower card cage.

Step 3 Carefully insert the assembly into the guiderails (see Figure 7-11).

Step 4 Using gentle pressure on the insertion/extraction tab, fully insert the assembly until the sheet metal carrier rests against the stops for the captive installation screws.

If the router is operational, you should hear the fans come up to normal rotational speed at this time.

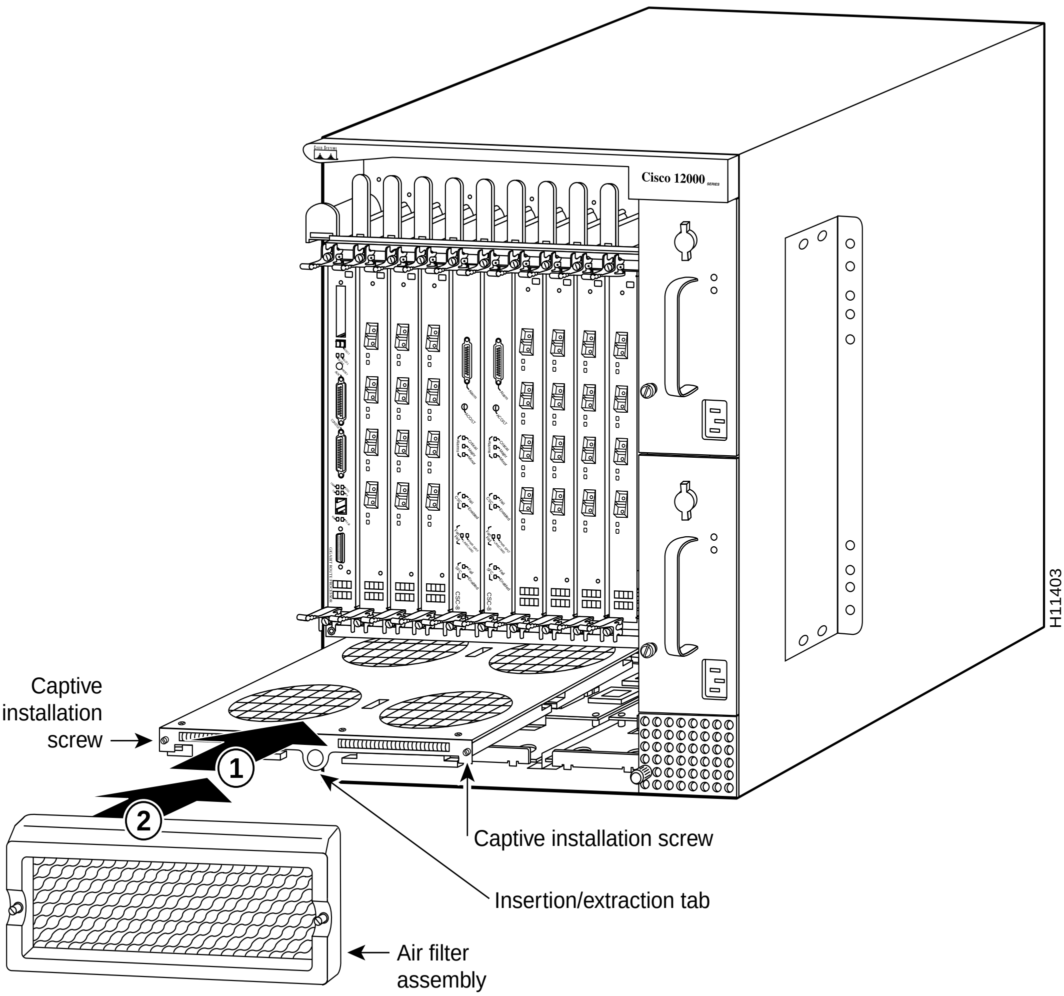
Note All electrical connections are a made automatically when the fan tray and backplane connectors mate. The fan tray then immediately powers up.

Step 5 Tighten the two captive installation screws at the sides of the fan tray carrier.

Step 6 Restore the air filter assembly so that it covers the lower card cage and fully encloses the router. Secure the assembly in place by tightening its two panel fastener screws.

To verify that the card cage fan tray is operating properly, go to the section entitled “Checking the Installation of a Fan Tray.”

Figure 7-11 Inserting the Card Cage Fan Tray into the Router



Removing the Power Supply Fan Tray

To remove the power supply fan tray from the router, perform the following steps.

Step 1 Loosen the captive installation screw on the honeycomb faceplate of the power supply fan tray (see Figure 7-12).

Step 2 With one hand, grasp the loosened installation screw on the power supply fan tray faceplate; gently pull the fan tray halfway out of the guide rails to disengage the fan tray connector from the backplane (see Figure 7-12).

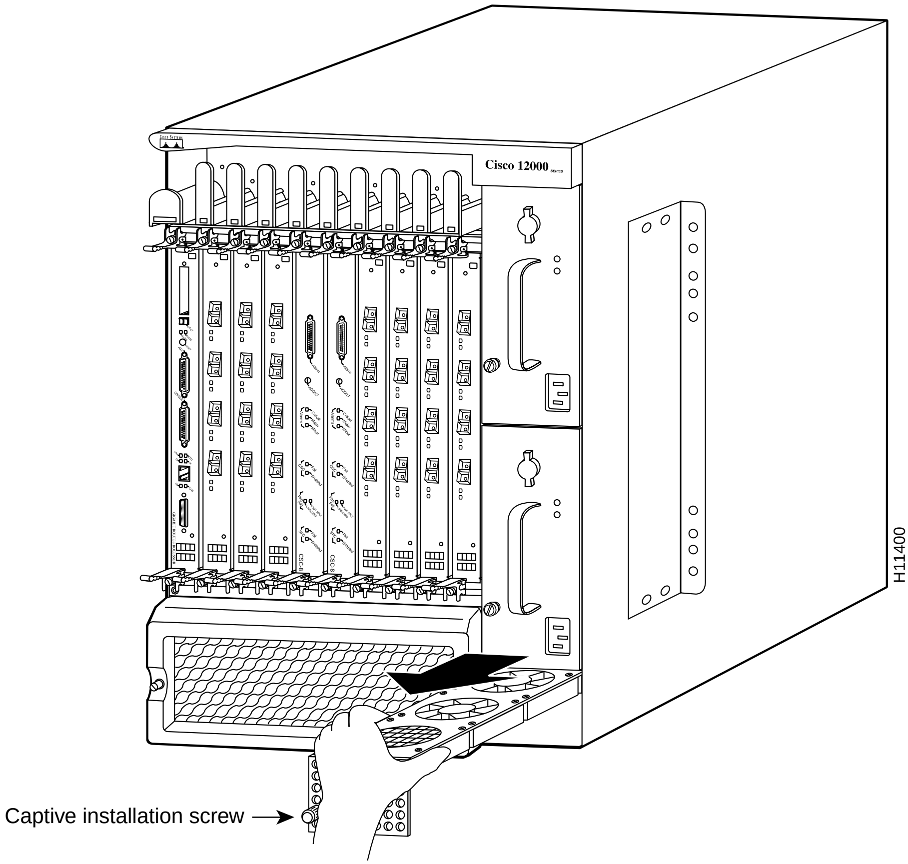
Caution For safety, make sure that the fans have stopped spinning before grasping the fan tray assembly. It will take several seconds for the fans to stop spinning once the assembly is disengaged from the backplane.

Step 3 Using one hand, grasp the fan tray from above and slide the assembly completely out of the router (see Figure 7-12).

Step 4 Set the fan tray aside.

If you plan to return the removed fan tray to the factory for repair or replacement, repackage the fan tray in the original shipping container, if available, and prepare the package for return shipment.

Figure 7-12 Removing the Power Supply Fan Tray from the Router



Installing the Power Supply Fan Tray

For the following procedure, it is assumed that you have already removed a defective power supply fan tray and that you intend to replace it with a new one.

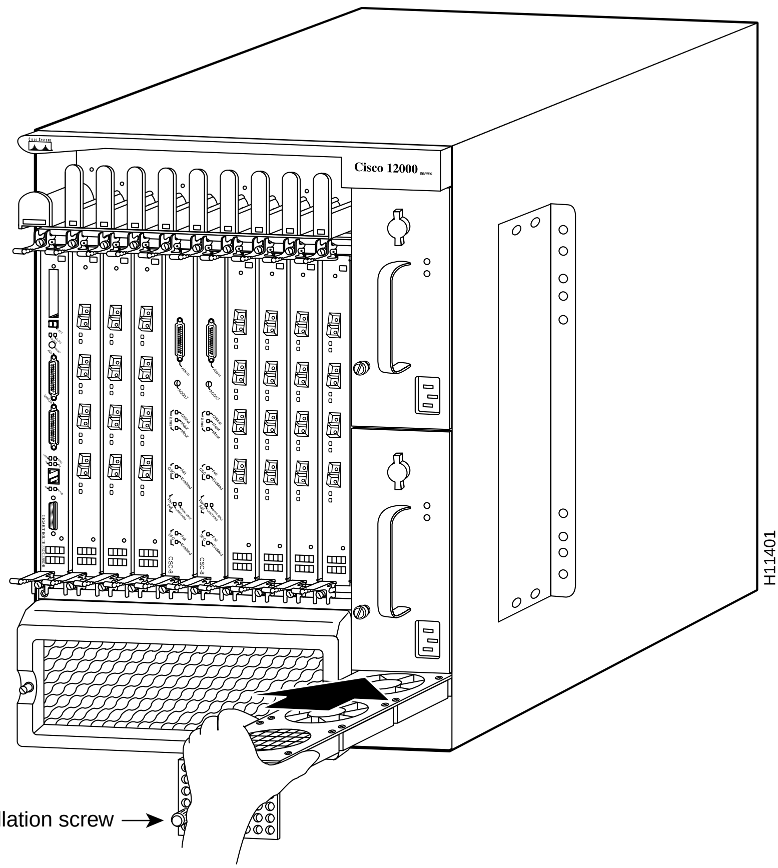
To install the new power supply fan tray, perform the following steps.

Step 1 Using one hand, grasp the power supply fan tray from above (as shown in Figure 7-13).

Step 2 Position the assembly in front of the guide rails in the fan tray bay.

Step 3 Carefully insert the fan tray into the guide rails in the bay (see Figure 7-13).

Figure 7-13 Inserting the Power Supply Fan Tray into the Router



Step 4 Using gentle pressure, fully insert the assembly into the bay until the sheet metal carrier of the fan tray rests against the stop for the captive installation screw.

Step 5 Tighten the captive installation screw on the fan tray faceplate (see Figure 7-13).

To verify that the power supply fan tray is operating properly, proceed to the following section.

Checking the Installation of a Fan Tray

To verify that a replacement fan tray is operating properly, perform the following steps:

Step 1 Check the following components to make sure that they are secure:

- The power supply fan tray is inserted all the way into the bay and its captive installation screw is tightened.
- The card cage fan tray is inserted all the way into the lower card cage and its two captive installation screws are tightened.
- The air filter assembly is securely installed on the front of the lower card cage.

Step 2 Observe the status LEDs on the CSC faceplate (see the following section entitled “Status LEDs for the Fan Trays”).

Step 3 Listen for the sound of the running cooling fans in the card cage fan tray and the power supply fan tray. In a noisy environment, it may be difficult to hear the fans running. If so, proceed to Step 4.

Step 4 Run your hand along the width of the top rear of the router enclosure to verify that air is being exhausted from the vents for the upper card cage and the power supply bays.

If either fan tray fails to operate properly, contact your Cisco service representative for assistance.

Status LEDs for the Fan Trays

The status LEDs for the fan trays are arranged side-by-side on the CSC faceplate (see Figure 7-14). The positions of these LEDs correspond to the positions of the fan trays in the router.

The left LED indicates the status of the card cage fan tray, and the right LED indicates the status of the power supply fan tray.

Table 7-1 lists the status LEDs for the fan trays and describes their meaning in the on/off state.

Table 7-1 Status LEDs for the Fan Trays

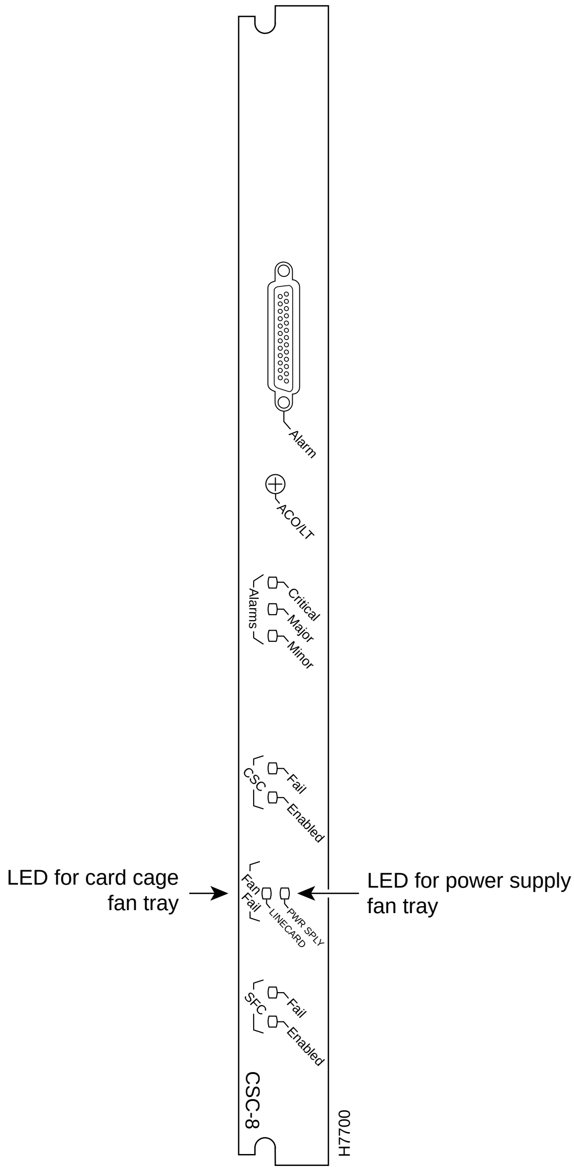
Status LEDs	State	Description
Left LED	On (amber)	Indicates that a fault exists in the card cage fan tray
Right LED	On (amber)	Indicates that a fault exists in the power supply fan tray
Both LEDs	Off	Indicates that both fan trays are operating normally

If a fan in one of the fan trays fails, the following occurs:

- Fan speed on both fan trays increases to the maximum rate, even in the absence of an over-temperature condition in the router.
- The appropriate status LED on the CSC faceplate goes on (see Figure 7-14), indicating which fan tray has failed.

You can check the status of the fan tray LEDs by issuing the **show environment leds** command at the privileged EXEC mode prompt. You can check the status of the fan trays themselves by issuing the **show environment all** command at the privileged EXEC mode prompt.

Figure 7-14 Fan Tray Status LEDs on the CSC



Removing and Replacing the RP

The following sections present the procedures for removing and replacing the RP. The RP can be installed in any of the upper card cage slots 0 through 3 and 4 through 7. By convention, however, it is normally installed in slot 0 (the left-most slot in the upper card cage).

Caution Removing the RP while the system is operating will cause the system to stop forwarding packets and might cause the system to cease network operation. Therefore, it is recommended that you not remove the RP while the system is operating. To avoid system problems, it is best to power down the router before removing or replacing the RP.

You will need the following tools and parts to remove and replace the RP.

- A 3/16-inch flat-blade screwdriver.
- ESD-prevention equipment or the disposable ESD-preventive wrist strap included with all spares and upgrade kits.
- Antistatic mat or foam pad (on which to place the RP if you plan to reinstall it) or an antistatic bag (to contain the removed RP if you plan to return it to the factory for repair or replacement).
- The GRP (product number GRP= or PRP=).

Note Before accessing any of the router's internal components, put on an antistatic wrist strap and make sure that it makes ample contact with your skin. Insert the equipment end of the wrist strap (the banana jack) into the ESD socket in the lower left corner of the upper card cage.

Caution An RP that is only partially removed from the backplane can halt the system.

Caution Before replacing the RP with another, back up the running configuration file to a Trivial File Transfer Protocol (TFTP) file server or an installed Flash memory card. Doing so enables you to retrieve the file later for reuse. If you do not back up the configuration file, it will be lost and you will have to manually reenter the configuration information for the router. If you are temporarily removing the RP and will be reinstalling it shortly, you need not back up the configuration file, because lithium batteries on the RP retain the configuration file in NVRAM until the RP is reinstalled.

Removing the RP

Although Figure 7-15 appearing later in this section illustrates a RP being removed from a Cisco 12012, the procedure for removing a RP from a Cisco 12008 is essentially identical. For purposes of the Cisco 12008 RP removal procedure, it is assumed that the RP is installed in slot 0 of the upper card cage.

To remove the RP from the Cisco 12008, perform the following steps:

Step 1 Set the rotary power switch(es) on the installed power supply(ies) to the Standby position (AC-input power supply) or the OFF position (DC-input power supply).

Step 2 If you are removing the RP from the system with the intent to replace it with another RP, copy the currently running configuration file to a TFTP server in the network or to a Flash memory card installed in either PCMCIA slot 0 or 1. Backing up the configuration file in this manner enables you to retrieve it later so that it can be copied to NVRAM on the new RP.

Step 3 Put on an antistatic wrist strap and make sure that it makes ample contact with your skin. Insert the equipment end of the wrist strap (the banana jack) into the ESD socket in the lower left corner of the upper card cage.

Step 4 If you are removing the RP with the intent to upgrade its memory (and will be reinstalling it shortly), you can leave any interface cables (for the console port, auxiliary port, and Ethernet ports) attached to the RP, provided that doing so will not strain the cables when you place the RP on an antistatic mat or foam pad to perform the memory upgrade procedure.

If the interface cables are not long enough to allow you to place the RP on an antistatic mat or foam pad without undue stress to the cables, disconnect the cables before removing the RP and proceeding with the memory upgrade task.

Step 5 Using a 3/16-inch flat-blade screwdriver, loosen the two captive screws at the top and bottom of the RP faceplate (see Figure 7-15a).

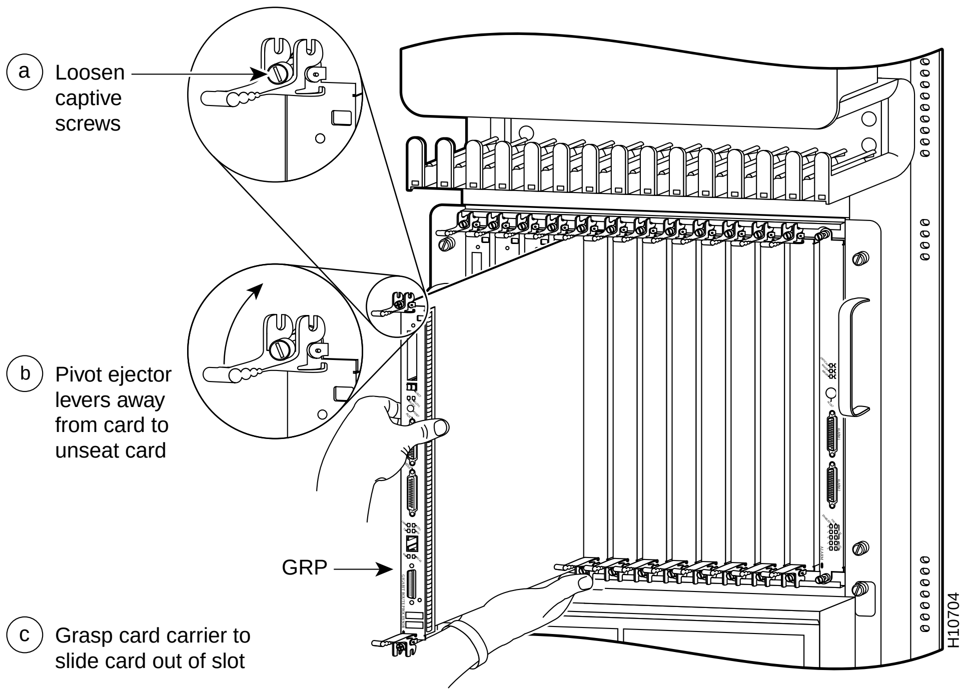
Step 6 Place your thumbs on each of the ejector levers and simultaneously pivot them away from the RP faceplate (see Figure 7-15b). This action disengages the RP from the backplane.

Step 7 Grasp the RP faceplate with one hand and pull the RP straight out of the slot; place your free hand beneath the RP to support its weight (see Figure 7-15c). Avoid touching the RP printed circuit board, its components, or its edge connector pins.

Step 8 Place the removed RP on an antistatic mat or foam pad.

If you plan to return the RP to the factory for repair or replacement, immediately place it in an antistatic bag for ESD protection.

Figure 7-15 Removing the RP (Cisco 12012 Shown)



Installing the RP

As noted in the preceding section, Figure 7-15 illustrates an RP being removed from a Cisco 12012. For purposes of the RP installation procedure presented in this section, it is assumed that you will be performing the reverse of the procedure illustrated in Figure 7-15, but in the context of the Cisco 12008. It is also assumed that you will be installing the RP in slot 0 of the upper card cage of the Cisco 12008.

To install the RP in the Cisco 12008, perform the following steps:

Step 1 Put on an antistatic wrist strap and make sure that it makes ample contact with your skin. Insert the equipment end of the wrist strap (the banana jack) into the ESD socket in the lower left corner of the upper card cage.

Step 2 Grasp the RP faceplate with one hand and place your free hand under the card carrier to support the weight of the card; avoid touching the RP printed circuit board, its components, or its edge connector pins.

Step 3 Position the RP for insertion into slot 0; align the top and bottom edges of the card carrier with the guiderails at the top and bottom of slot 0.

Step 4 Carefully slide the RP into slot 0 until the ejector levers make contact with the top and bottom lip of the upper card cage enclosure.

Step 5 Using the thumb and forefinger of each hand, simultaneously pivot both ejector levers toward the center of the RP faceplate until they are perpendicular to the faceplate. This action fully seats the RP in the backplane.

Caution An RP that is only partially seated in the backplane can halt the system.

Step 6 Using a 3/16-inch flat-blade screwdriver, tighten the captive installation screws at the top and bottom of the RP faceplate.

Step 7 If you previously disconnected the interface cables from the console, auxiliary, and Ethernet ports to remove the RP, or if you are installing a new RP, connect the interface cables to the appropriate ports on the RP.

Step 8 Ensure that the console terminal is turned on.

Step 9 Turn the rotary power switch(es) on the power supply(ies) to the ON position to apply system power.

This completes the RP replacement procedure.

Checking the Installation of the RP

To verify that the new (or reinstalled) RP is functioning properly, perform the following steps:

Step 1 Verify the following conditions:

- The RP is fully seated and its two captive installation screws are tightened.
- The RP interface cables are connected and secure.
- Any Flash memory cards removed from the old RP are reinstalled in the new RP.

Step 2 Ensure that a console terminal is connected to the console port on the RP and that the console is turned on, or that you are able to accomplish a remote login to the router from another host in the network by means of a telnet session.

Step 3 Check the startup banner and displays to ensure that the system restarts properly and that all the router interfaces reinitialize in the proper state.

Removing and Replacing Line Cards

Procedures for removing and replacing line cards are described in conjunction with the memory upgrade procedures presented in the section entitled “Upgrading Memory on a Line Card.”

Removing and Replacing Switch Cards

This section presents the procedures for removing, installing, and verifying the installation of the CSC and the SFC.

Note The Cisco 12008 supports an online insertion and removal (OIR) feature; thus, you can remove and replace a redundant CSC or any of the SFCs without powering down the system. If you do not have redundant CSCs in your router (that is, your router is equipped with a single CSC), you must power down the system before removing the CSC card.

When you install a new CSC or SFC, the router’s OIR capability enables the new card to be recognized, initialized, and become operational in a transparent manner.

For the procedures in this section, it is assumed that you will be removing and replacing a switch card from a fully redundant and operational router.

When you replace a failed switch card, only four switch planes remain available to the router. For the duration of the replacement procedure, no redundant plane exists to take over if any other switch plane fails.

Under normal operating conditions in a fully redundant system, you would not leave a CSC slot or an SFC slot vacant for any length of time beyond that required to replace a failed card.

Two dedicated slots (CSC0 and CSC1) in the middle of the upper card cage are reserved for exclusive use by CSCs. Three dedicated slots (SFC0, SFC1, and SFC2) in the lower card cage are reserved for exclusive use by SFCs.

You will need the following tools and parts to install or replace a switch card:

- 1/4-inch flat-blade screwdriver
- ESD-preventive wrist strap
- Clock and scheduler card (CSC)—product number GSR8-CSC=
- Switch fabric card (SFC)—product number GSR8-SFC=

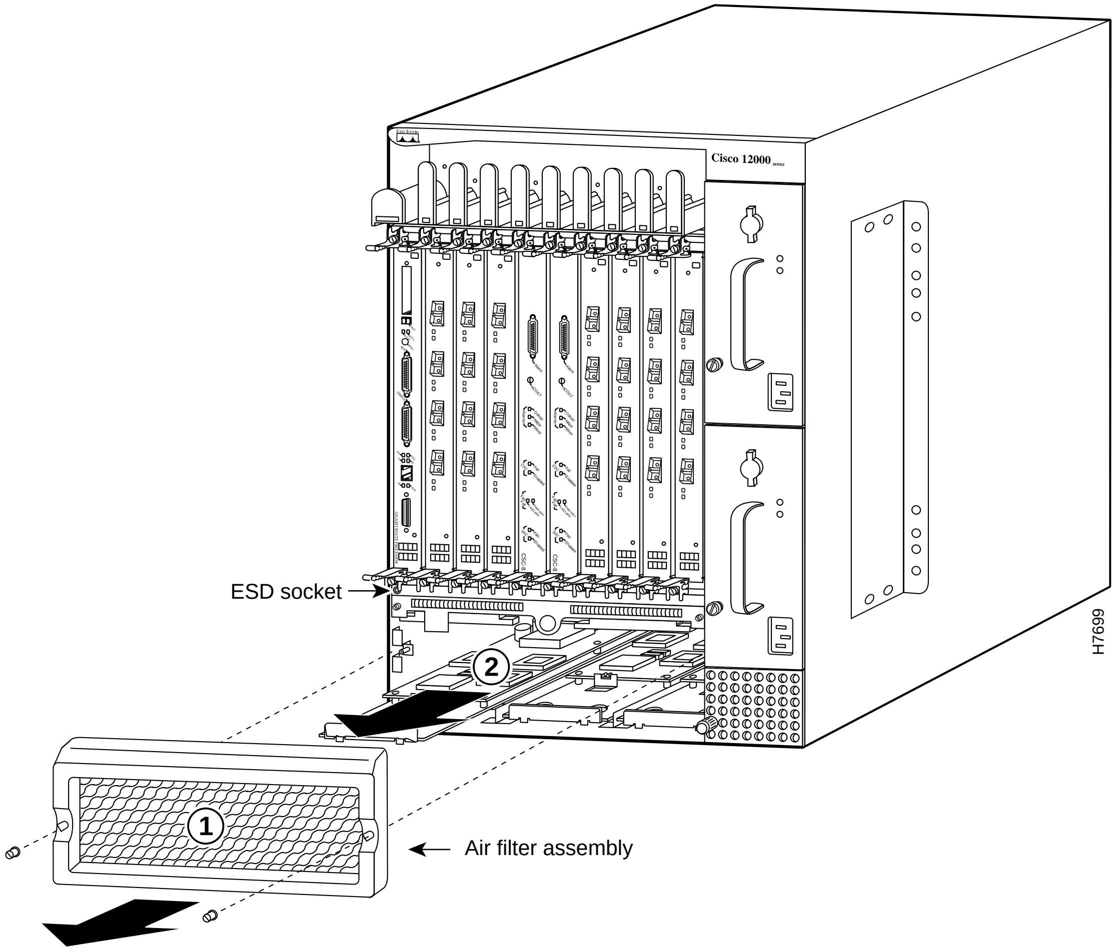
Removing an SFC

To remove an SFC from the router, perform the following steps.

Note Before accessing any of the router’s internal components, put on an antistatic wrist strap and make sure that it makes ample contact with your skin. Insert the equipment end of the wrist strap (the banana jack) into the ESD socket in the lower left corner of the upper card cage.

Step 1 Loosen the two panel fastener screws on each side of the air filter assembly (see Figure 7-16); remove the assembly and set it aside.

Figure 7-16 Removing an SFC



Step 2 Grasp the front of the card carrier's metal faceplate, unseat the card from the backplane, and slide the SFC out of the slot, supporting the weight of the card by placing your other hand underneath the card carrier. Store the SFC in an antistatic bag or in an antistatic rack.

Step 3 If you intend to return the card for repair or replacement, leave the card in its antistatic bag and prepare a return package for shipment.

Caution Do not place any tools in the lower card cage. Also, be careful not to damage the honeycomb screen in the air filter assembly. Damaging this screen might restrict the flow of cooling air through the switch router, causing an overtemperature condition in the router.

Installing an SFC

To install an SFC in the router, perform the following steps:

Note Before accessing any of the router's internal components, put on an antistatic wrist strap and make sure that it makes ample contact with your skin. Insert the equipment end of the wrist strap (the banana jack) into the ESD socket in the lower left corner of the upper card cage.

Step 1 With one hand, grasp the new SFC by its faceplate; support the weight of the card by placing your free hand beneath the card carrier.

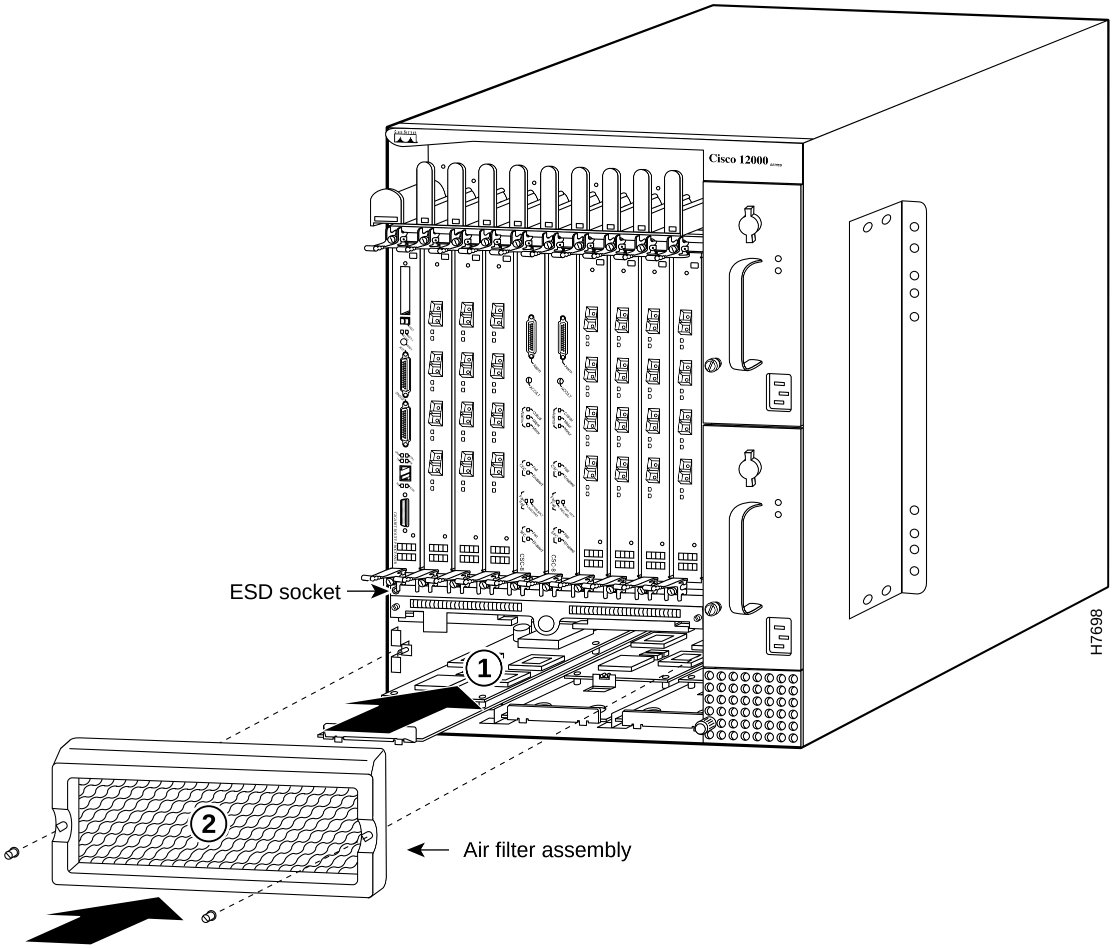
Step 2 Position the card horizontally and insert it into the vacant slot until the SFC is firmly seated in the backplane (see Figure 7-17).

Step 3 Restore the air filter assembly to the router to fully enclose the lower card cage. Secure the assembly in place by tightening its two panel fastener screws.

This completes the procedure for removing and installing an SFC.

To verify the operability of the new SFC, perform the procedure in the section entitled "Checking the Installation of Switch Cards."

Figure 7-17 Installing an SFC



Removing a CSC

To remove a CSC from the router, perform the following steps.

Note Before accessing any of the router's internal components, put on an antistatic wrist strap and make sure that it makes ample contact with your skin. Insert the equipment end of the wrist strap (the banana jack) into the ESD socket in the lower left corner of the upper card cage.

Step 1 Loosen the two captive installation screws beneath the card ejector levers at the top and bottom of the card (see Figure 7-18).

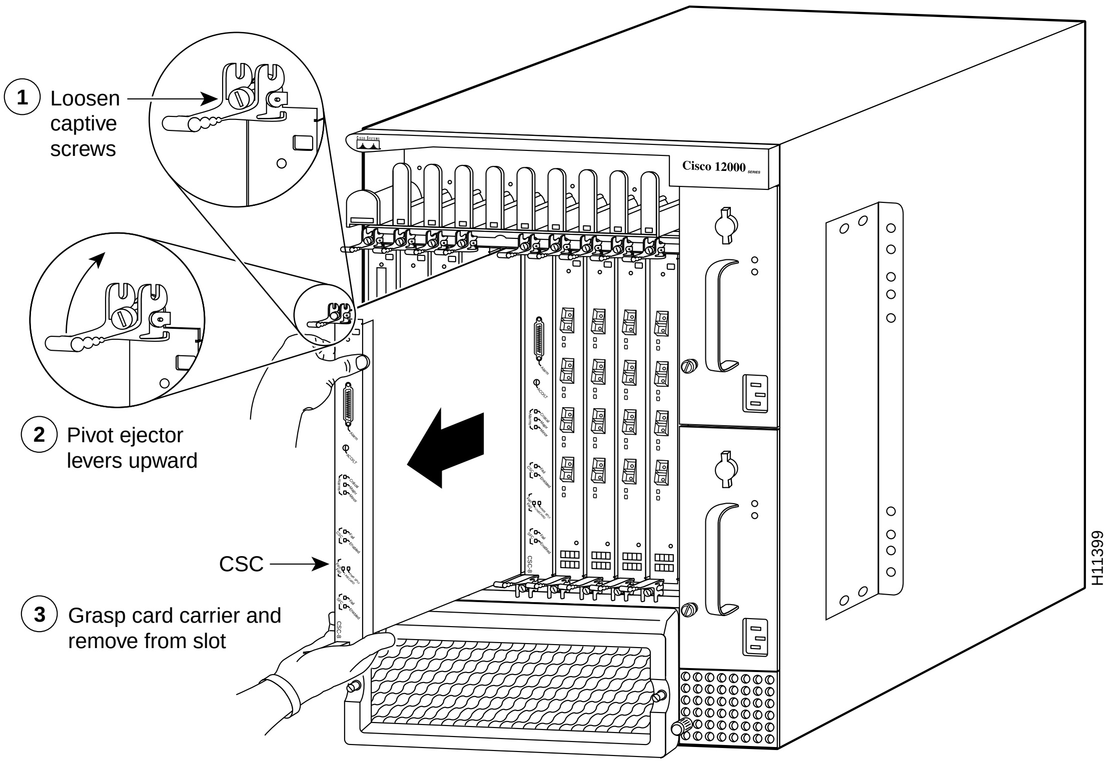
Step 2 Grasp the ejector levers and pull them away from the card faceplate to unseat the card from the backplane (see Figure 7-18).

Step 3 Touching only the ejector levers or the metal card carrier proper, slide the card out of the slot and store it in an antistatic bag or in an antistatic card rack (see Figure 7-18).

Step 4 If you intend to return the card for repair or replacement, leave the card in its antistatic bag and prepare a return package for shipment.

At the conclusion of this procedure, you must either install a replacement CSC or a blank filler panel to maintain the integrity of the router enclosure. Doing so is essential to maintain the proper flow of cooling air through the router and to ensure EMI compliance.

Figure 7-18 Removing a CSC



Installing a CSC

To install a CSC in the router, perform the following steps.

Note Before accessing any of the router's internal components, put on an antistatic wrist strap and make sure that it makes ample contact with your skin. Insert the equipment end of the wrist strap (the banana jack) into the ESD socket in the lower left corner of the upper card cage.

Step 1 With one hand, grasp the new CSC by its faceplate; support the weight of the card by placing your free hand beneath the card carrier.

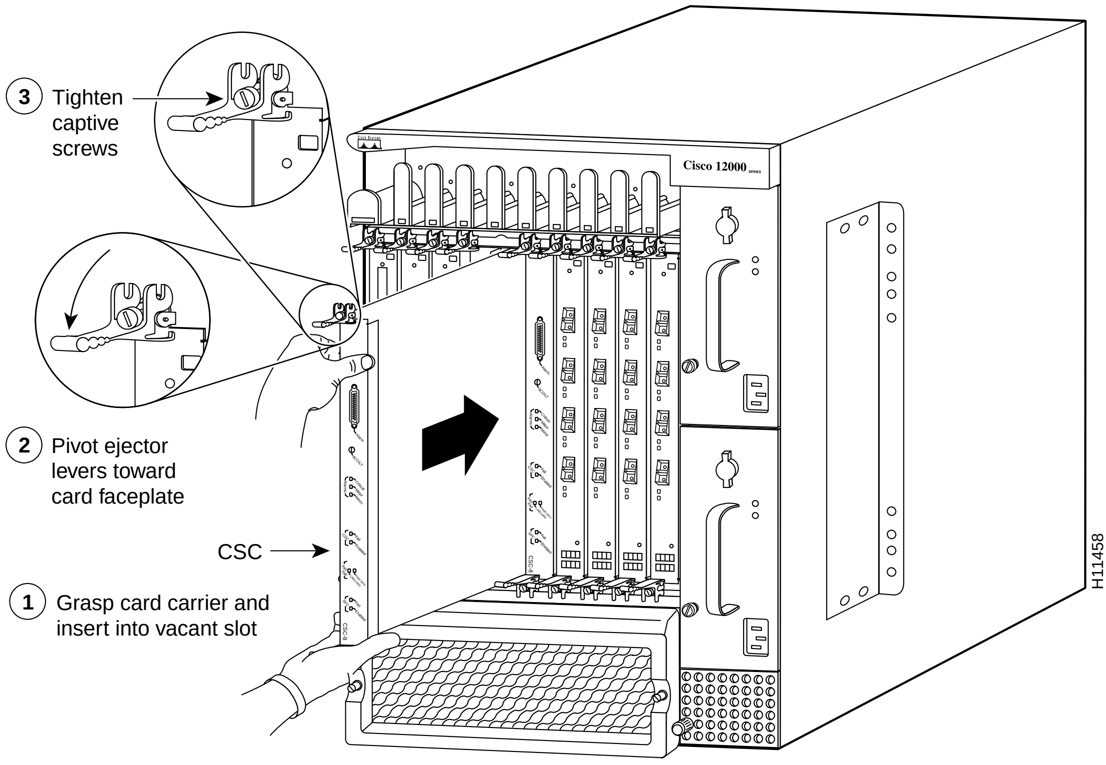
Step 2 Position the card vertically and insert it into the vacant slot in the upper card cage until the card's ejector levers meet the retention lips at the top and bottom of the enclosure (see Figure 7-19).

Step 3 Pivot the ejector levers toward the card faceplate to engage the retention lips at the top and bottom of the enclosure and firmly seat the card in the backplane (see Figure 7-19).

This completes the procedure for removing and installing a CSC.

To verify that the new CSC is operating properly, perform the procedure in the following section.

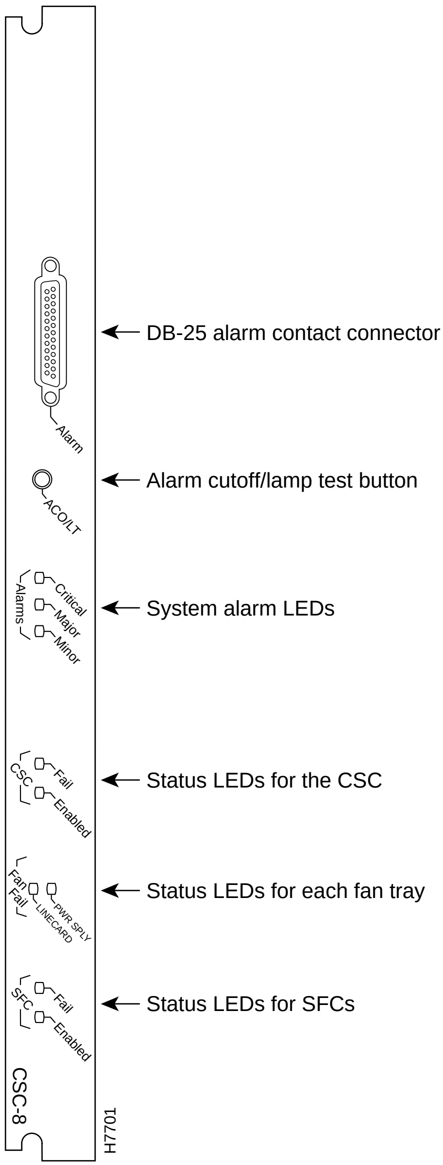
Figure 7-19 Installing a CSC



Checking the Installation of Switch Cards

This section tells you how to verify the operability of a newly installed switch card. Refer to Figure 7-20 while performing the following procedures.

Figure 7-20 Status LEDs on a CSC



To verify that a new switch card is operating properly, perform the following steps:

Step 1 Observe the LEDs on the faceplate of the CSC(s), as follows:

- For a new CSC—Observe the two status LEDs for the CSC (refer to Figure 7-20). If the bottom (ENABLED) LED is on (green), the new CSC is operational. If the top (FAIL) LED is on (amber), the new CSC is faulty (see Table 7-2). In this case, proceed to Step 3.

Table 7-2 Status LEDs for the CSC

Status LEDs	State	Description
Top LED (FAIL)	On (amber)	Indicates that the CSC is faulty
Bottom LED (ENABLED)	On (green)	Indicates that the CSC is operational

- For a new SFC—The first (primary) indication of SFC status is provided by the status LEDs for the SFCs located at the bottom of the CSC faceplate (see Figure 7-20).

  If the bottom (ENABLED) LED is on (green), the installed SFCs are operational (see Table 7-3). This ends the validation procedure, except for returning the air filter assembly to its proper place (see Step 3).

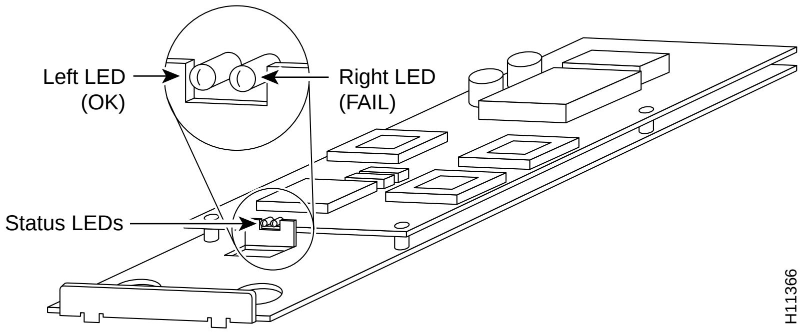
  If the top (FAIL) LED is on (amber), one or more of the installed SFCs is faulty (see Table 7-3). In this case, proceed with Step 2.

Table 7-3 Status LEDs for the SFCs

Status LEDs	State	Description
Top LED (FAIL)	On (amber)	Indicates that a fault has been detected in one or more of the SFCs.
Bottom LED (ENABLED	On (green)	Indicates that the SFCs are installed and operating normally.
Both LEDs	Off	Indicates that no SFCs are installed in the router.

Step 2 The secondary indication of SFC status is provided by two LEDs on each SFC (see Figure 7-21).

Figure 7-21 Status LEDs on an SFC



Observe each pair of LEDs on each SFC for the following indications:

- If the left LED (OK) is on (green), the SFC is operational.
- If the right LED (FAIL) is on (amber), the SFC is faulty. In this case, proceed with Step 3.

Step 3 If the new switch card is faulty, perform the following steps, as appropriate:

- Reseat the card in the slot and again observe its LEDs, as outlined in Step 1, Table 7-2, and Table 7-3.
- If the associated LEDs for the card continue to indicate that the card is faulty, replace the card with a new one and repeat the verification procedure. If this does not resolve the problem, contact your Cisco service representative for assistance.
- If you have installed new SFCs in the lower card cage and they pass the validation tests (as affirmed by the state of the primary and secondary LEDs noted in Step 1 and Table 7-3, respectively), replace the air filter assembly and secure it in place with the two captive installation screws.

In Step 2 above, since the SFCs are not visible during normal operation, you must remove the air filter assembly from the router to observe the status LEDs on each SFC (see Figure 7-21). These LEDs are arranged side-by-side behind a raised tab near the middle of the card (as you view the SFC from the front of the router).

Alternatively, you could issue the following command at the privileged EXEC mode prompt to show the status of all the router's LEDs:

```
router# show environment leds
```

If the CSC indicates a fault with an SFC, you must still remove the air filter assembly from the switch router and observe the status LEDs on the SFCs themselves to determine which card is at fault.

Removing and Replacing the Cable Management System

This section presents procedures for removing and installing a cable-management tray or a cable-management bracket for the Cisco 12008.

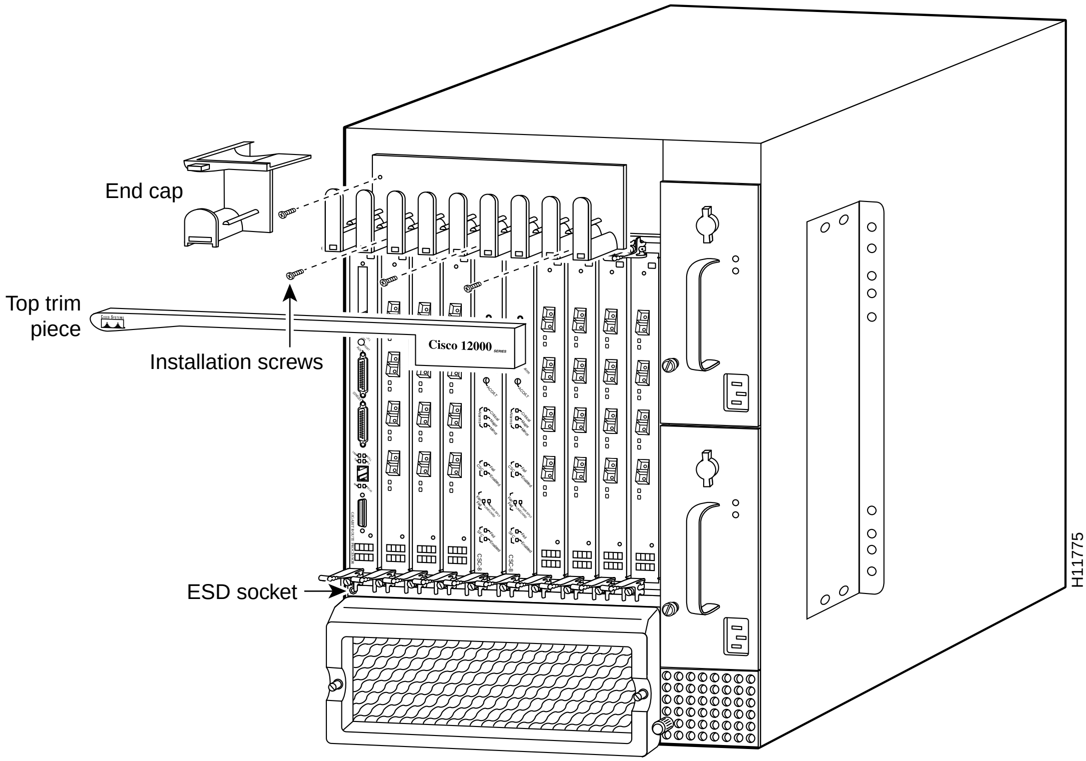
To perform these procedures, you will need the following tools:

- 1/4-inch flat-blade screwdriver
- Number 1 Phillips screwdriver
- ESD-preventive wrist strap
- ACS-GSR8-CCBLM(=)—Cable-management tray
- ACS-GSR-LCCBLM(=)—Cable-management bracket

Removing a Cable-Management Tray

The cable-management tray (ACS-GSR8-CCBLM) is actually three pieces: end cap, top trim, and tray (see Figure 7-22).

Figure 7-22 Cable-Management Tray on a Cisco 12008

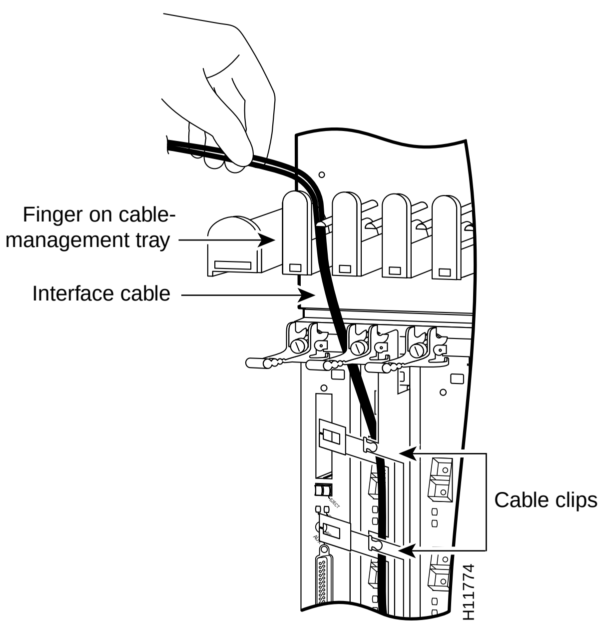


To remove the cable-management tray while the system is operating, perform the following steps.

Note Before accessing any of the router's internal components, put on an antistatic wrist strap and make sure that it makes adequate contact with your skin. Insert the equipment end of the wrist strap (the banana jack) into the ESD grounding socket on the lower left edge of the upper card cage (see Figure 7-24).

Step 1 Proceeding from left to right in the upper card cage, select the first line card. Starting with the interface cable for the bottom port on the line card (for cards with multiple ports), remove it from the associated finger on the cable-management tray (see Figure 7-23). Continue this for each interface cable.

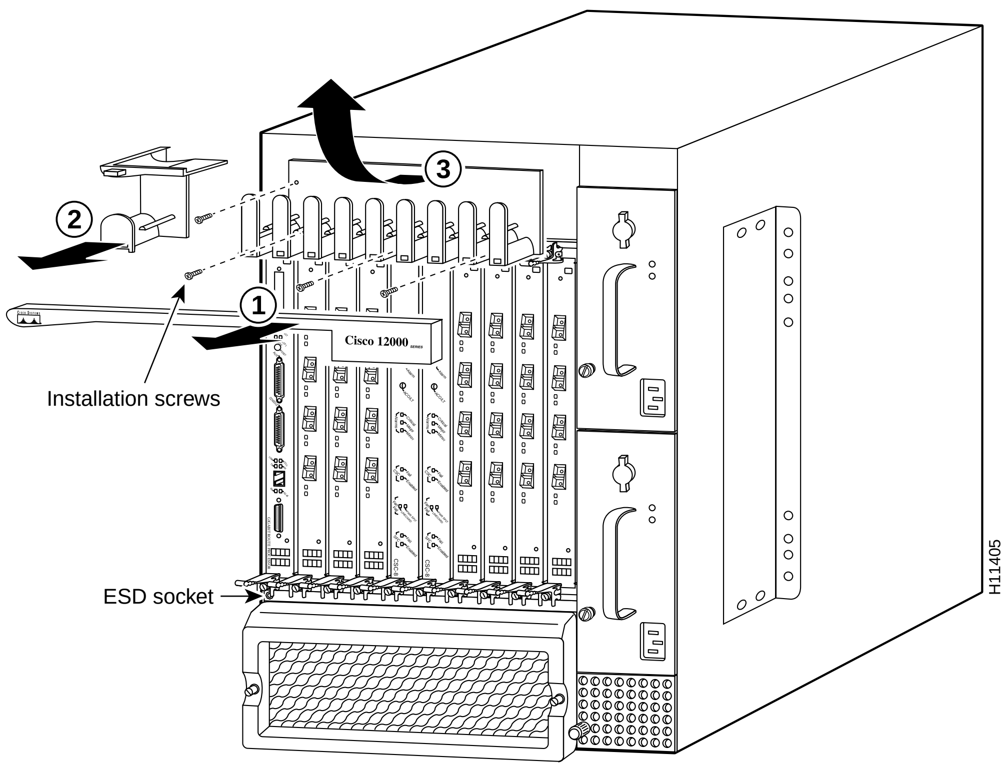
Figure 7-23 Removing an Interface Cable from Cable-Management Tray



Step 2 Once the interface cables are removed from the cable-management tray, position the interface cables out of the way in preparation for removal of the cable-management tray.

Step 3 Remove the four installation screws securing the cable-management tray to the recessed router enclosure (see Figure 7-24). Save the screws for possible future use.

Figure 7-24 Removing the Cable-Management Tray from the Cisco 12008



Step 4 Remove the top trim piece from the chassis by pulling it away from the chassis fasteners (see Figure 7-24, part 1).

Step 5 Remove the end cap (left-most, large finger piece) from the chassis by pulling it away from the chassis fasteners (see Figure 7-24, part 2).

Step 6 Pivot the bottom of the cable-management tray away from the recessed router enclosure (see Figure 7-24, part 3).

Step 7 Remove the cable-management tray from the router and set it aside.

This completes the removal procedure for the Cisco 12008 cable-management tray.

Installing a Cable-Management Tray

This section tells you how to install a cable-management tray in the Cisco 12008.

Note Before accessing any of the router's internal components, put on an antistatic wrist strap and make sure that it makes adequate contact with your skin. Insert the equipment end of the wrist strap (the banana jack) into the ESD grounding socket on the lower left edge of the upper card cage (see Figure 7-24).

To install a cable-management tray while the system is operating, perform the following steps:

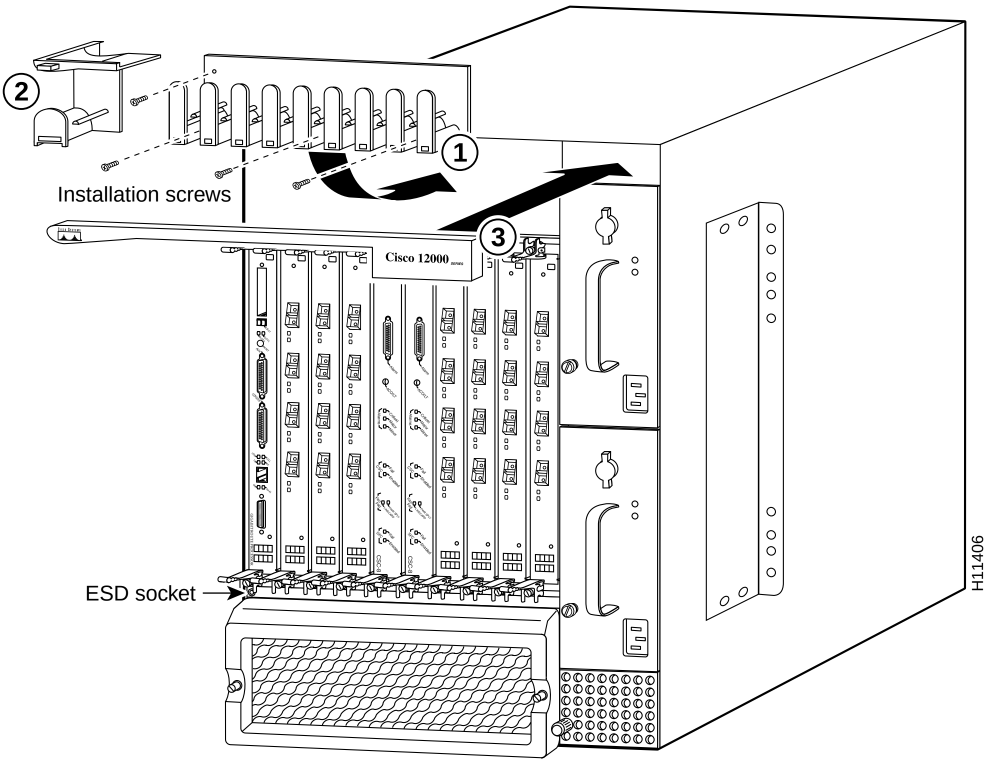
Step 1 Remove the replacement cable-management tray from its shipping container.

Step 2 Position the cable-management tray at an angle so that its top is oriented toward the tray recess in the router enclosure (see Figure 7-25).

Step 3 Pivot the bottom of the cable-management tray inward toward the router until it is flush against the sheet metal in the tray recess (see Figure 7-25, part 1).

Step 4 Secure the cable-management tray in the recess with the two right-most installation screws that you set aside in the previous section entitled "Removing a Cable-Management Tray."

Figure 7-25 Installing a Cable Management Tray



Step 5 Install the end cap onto the chassis by pushing it onto the chassis fasteners (see Figure 7-25, part 2).

Step 6 Secure the cable-management tray in the recess with the remaining two installation screws that you set aside in the previous procedure entitled “Removing a Cable-Management Tray.”

Step 7 Install the top trim piece onto the chassis by pushing it onto the chassis fasteners (see Figure 7-25, part 3).

Step 8 Carefully arrange the attached interface cables in the bottom of the cable-management tray so that they emerge from the tray directly over the intended line card (see Figure 7-29).

This completes the installation procedure for the Cisco 12008 cable-management tray.

Removing a Cable-Management Bracket

This section tells you how to remove a cable-management bracket from the Cisco 12008.

Note Before accessing any of the router's internal components, put on an antistatic wrist strap and make sure that it makes adequate contact with your skin. Insert the equipment end of the wrist strap (the banana jack) into the ESD grounding socket on the lower left edge of the upper card cage (see Figure 7-24).

To remove a cable-management bracket from a line card, perform the following steps:

Step 1 On a piece of paper, list the current interface cable connections to the port(s) on each line card.

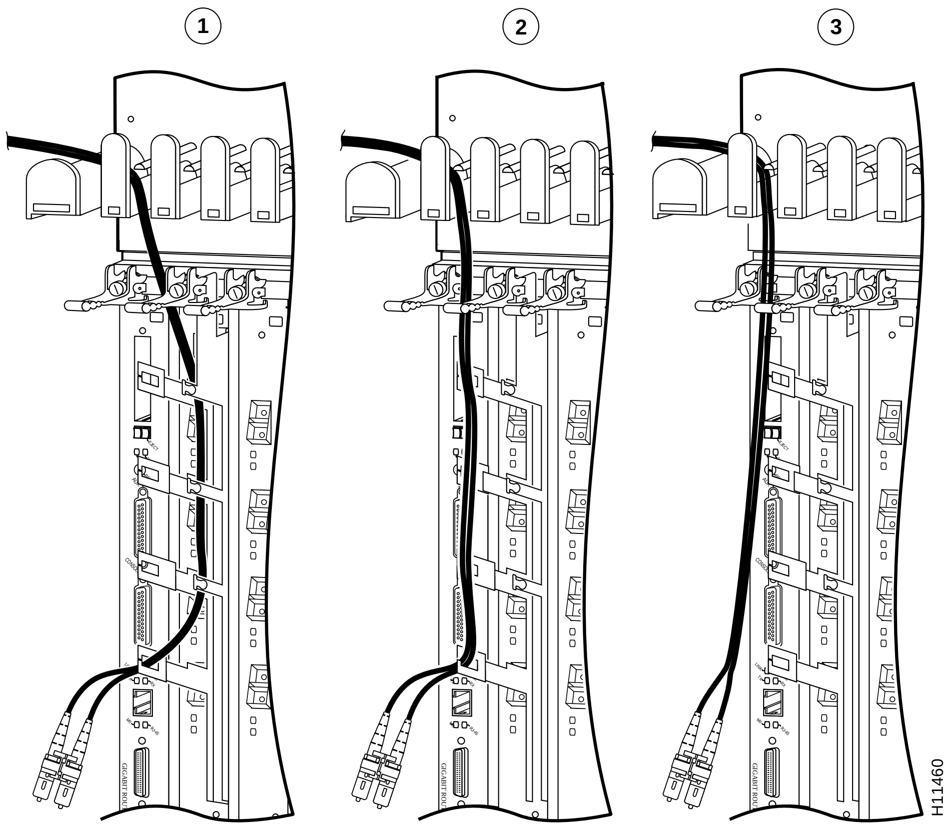
Note This step may be unnecessary. If the interface cables were originally installed properly, the length of each cable should leave little question regarding the port to which it should be connected.

Step 2 Starting with the interface cable for the bottom port on the line card (for cards with multiple ports), disconnect the cable from the bottom line card port (see Figure 7-26a).

Step 3 Proceeding upward, remove the interface cable from between all the metal fingers supporting the cable keeper clips (see Figure 7-26b).

Step 4 Remove the interface cable from the associated cable keeper clip, as shown in Figure 7-26c). Set the cable aside for later use.

Figure 7-26 Removing Interface Cables from a Line Card



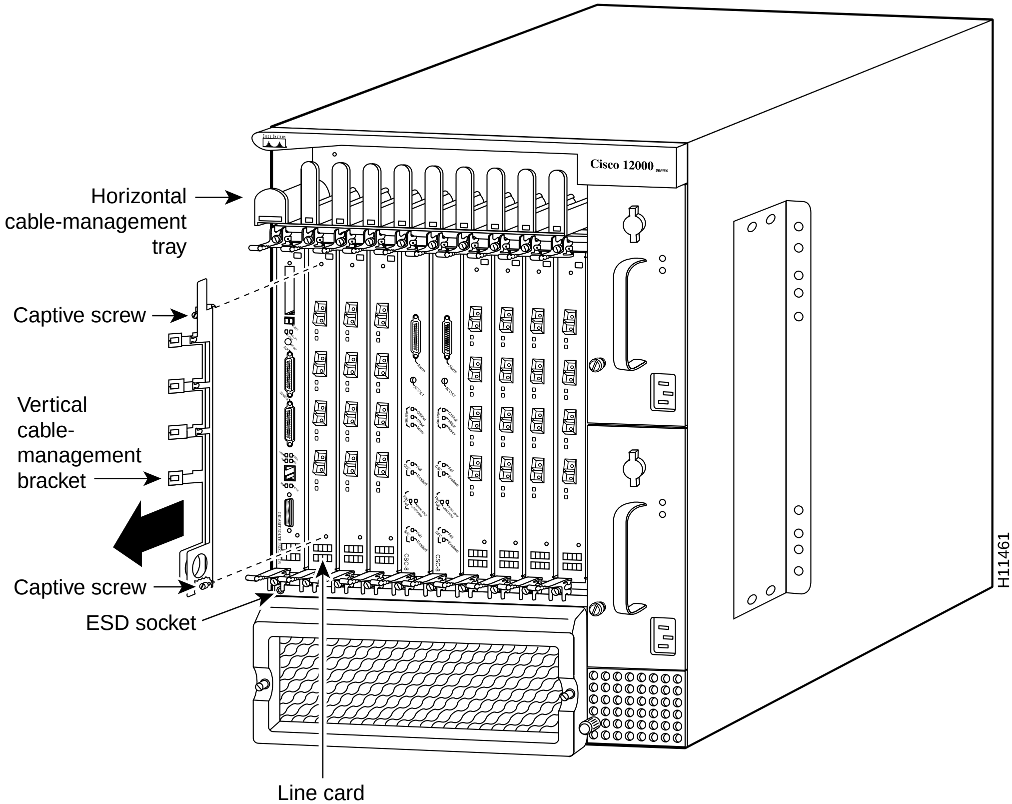
Step 5 Go back to Step 2 and proceed through the cable removal procedure in a bottom to top direction until you have removed all of the interface cables from the line card ports.

Step 6 Once all of the line card interface cables are removed, loosen the captive installation screws at the top and bottom of the cable-management bracket (see Figure 7-27).

Step 7 Remove the cable-management bracket from the line card.

This completes the removal procedure for the Cisco 12008 cable-management bracket.

Figure 7-27 Removing the Cable-Management Bracket



Installing a Cable-Management Bracket

For the procedure in this section, it is assumed that you have installed a new line card in the router, in which case you must also install a cable-management bracket on the card. A small hook on the top of the cable-management bracket allows you to hook the bracket onto small cutouts on the cable-management tray during a line card replacement procedure.

Note Before accessing any of the router's internal components, put on an antistatic wrist strap and make sure that it makes adequate contact with your skin. Insert the equipment end of the wrist strap (the banana jack) into the ESD grounding socket on the lower left edge of the upper card cage (see Figure 7-24).

To install a cable-management bracket on a line card, perform the following steps:

Step 1 Attach the cable-management bracket to the line card by means of the two captive installation screws at the top and bottom of the cable-management bracket (see Figure 7-28).

Step 2 Carefully arrange the interface cables in the cable-management tray (for line cards with multiple ports); determine the appropriate length of each cable for the intended port and route the cables down to the line card ports.

Step 3 Starting with the bottom port on the line card, connect the interface cables to the intended port (see Figure 7-29, part 1).

Step 4 Carefully press the interface cable into the associated cable keeper clip on the cable-management bracket clip (see Figure 7-29, part 2). Avoid any kinks or sharp bends in the cable.

Step 5 Proceeding upward, carefully press the interface cable between the metal fingers that support the cable keeper clips (see Figure 7-29, part 3).

Step 6 Go back to Step 3 and proceed through the cable attachment procedure in a bottom-to-top direction until you have attached all the interface cables to the line card ports.

This completes the installation procedure for the Cisco 12008 cable-management bracket.

Figure 7-28 Attaching a Cable-Management Bracket to a Line Card

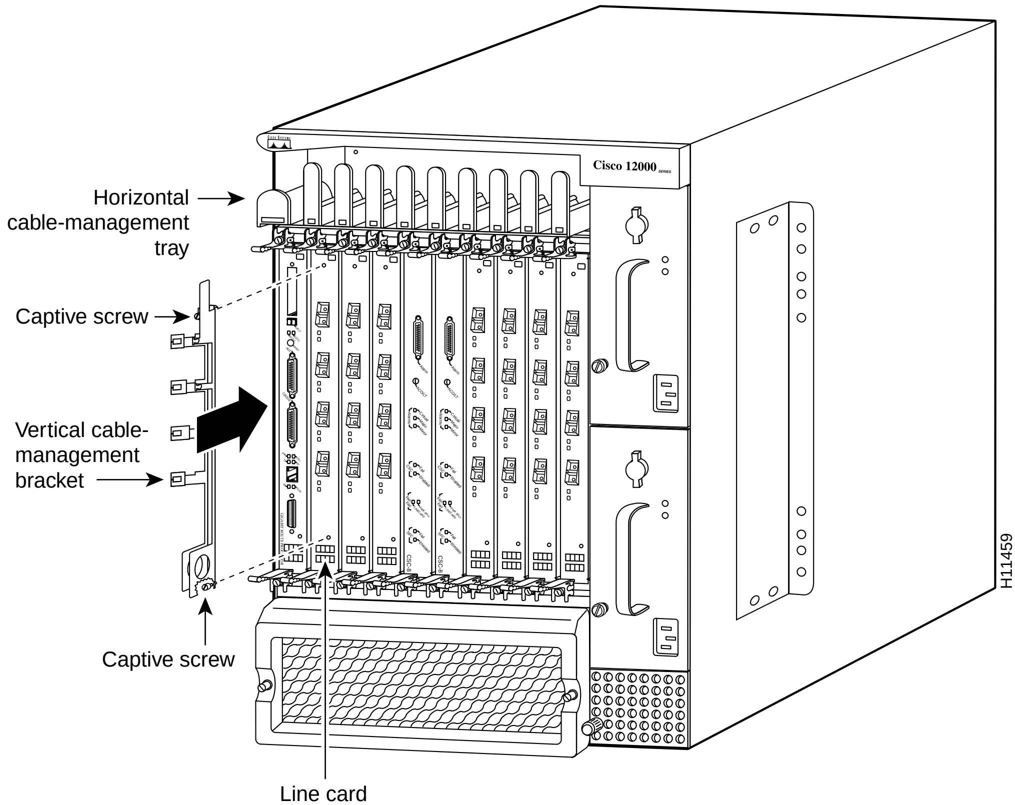
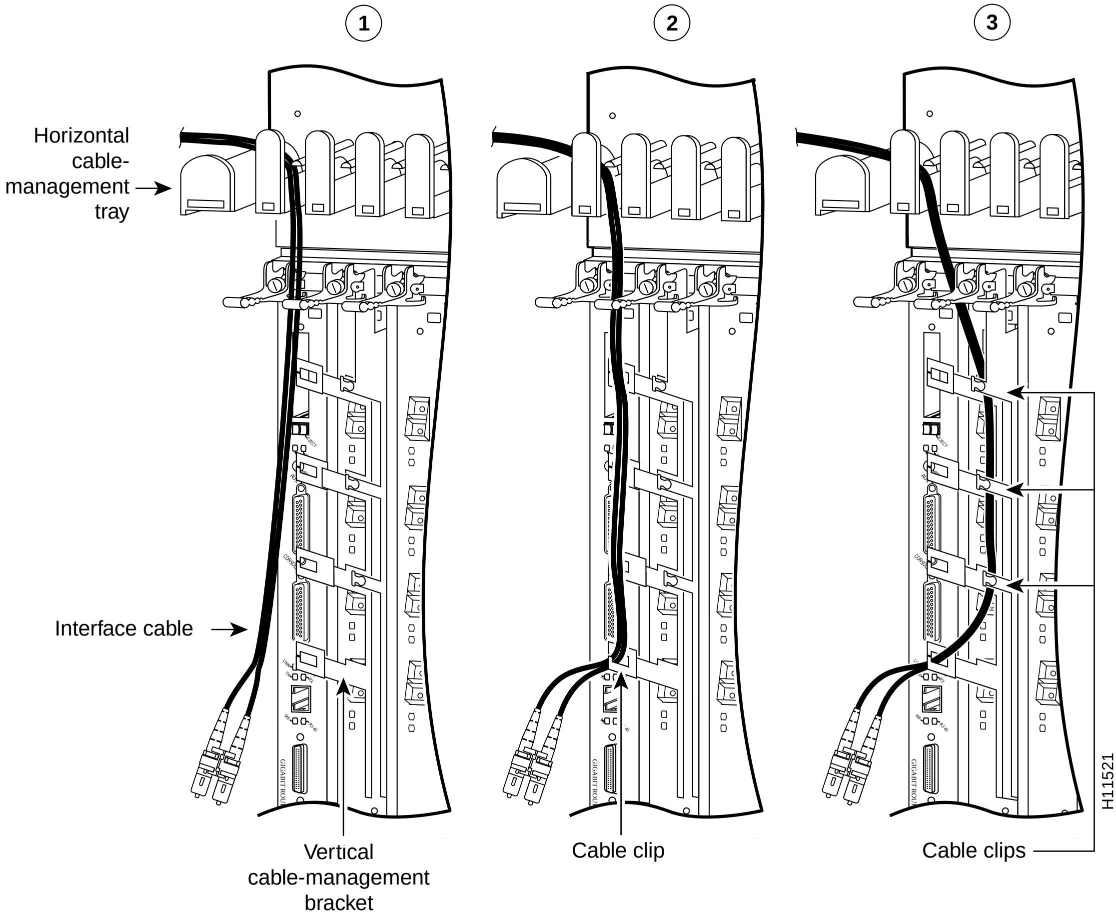


Figure 7-29 Installing Interface Cables onto a Line Card



Upgrading Memory on a Line Card

This section presents the procedures for upgrading memory on a Cisco 12000 series line card.

The Cisco 12000 series line cards used with the Cisco 12008 incorporate the following types of onboard memory:

- DRAM—Each Cisco 12000 series line card has two DRAM DIMM sockets (see Figure 7-30). The DRAM is used by the line card's processor. The default DRAM configuration for the line card's processor is 32 MB—one 32-MB DIMM in socket P4 DIMM0.
- SDRAM—Each Cisco 12000 series line card incorporates four SDRAM DIMM sockets (see Figure 7-30). The SDRAM is used by the line card's transmit and receive buffers. The default SDRAM configuration for a line card receive (RX) or transmit (TX) buffer is 16 MB.

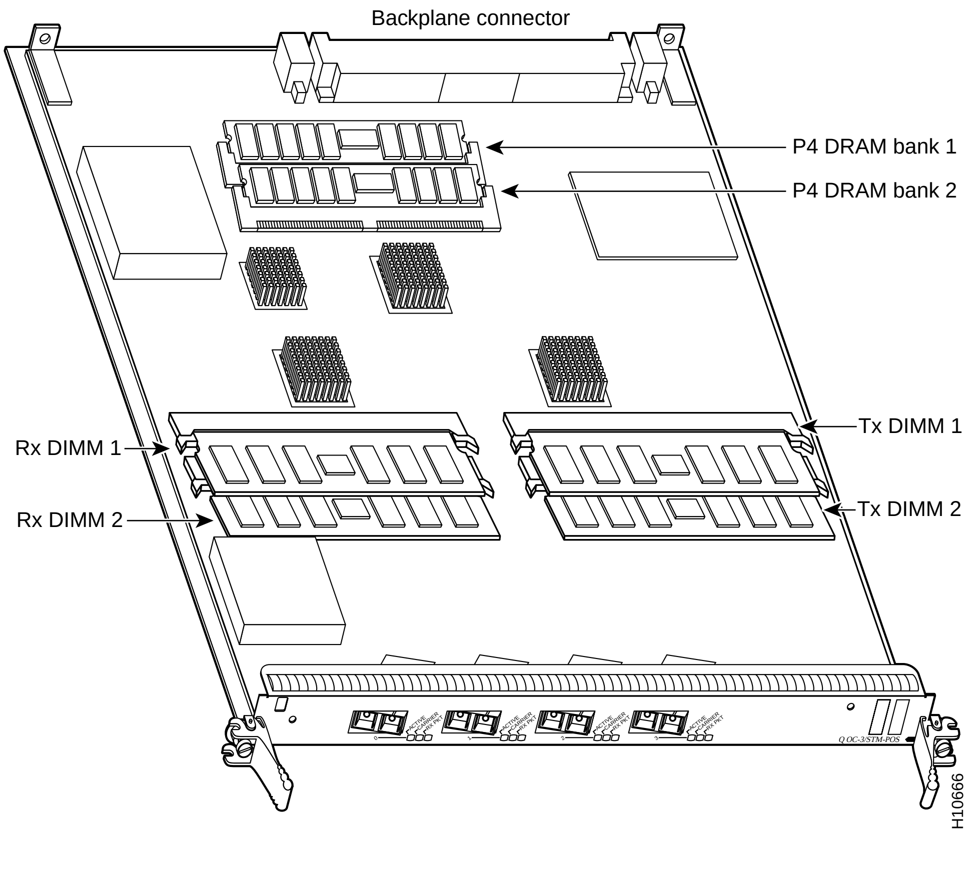
  All four SDRAM DIMM sockets must be populated with DIMMs to enable the receive and transmit buffers to operate properly. Also, both DIMMs installed in a given buffer pair (either transmit or receive) must be of the same size; however, the size of the DIMMs installed in the pair of transmit buffers need not be the same as the size of those installed in the pair of receive buffers, and vice versa.

Both types of memory in the Cisco 12000 series line cards can be upgraded in the field.

You will need the following tools to install or replace memory on the Cisco 12000 series line cards:

- 1/4-inch flat-blade screwdriver
- 3/16-inch flat-blade screwdriver
- Your own ESD-prevention equipment or the disposable grounding wrist strap included with all upgrade kits, field-replaceable units (FRUs), and spares for the Cisco 12000 series routers
- An antistatic mat or surface
- Small needle nose pliers
- The appropriate DRAM DIMM or SDRAM DIMM module(s) for configuring memory in the desired amount (see Table 7-4 or Table 7-5).

Figure 7-30 Memory Locations on Cisco Series 12000 Line Cards (Quad OC-3c/ STM-1C POS Card Shown)



Before attempting to upgrade line card memory, consult Table 7-4 or Table 7-5 to determine the particular DIMM module(s) that you will need to achieve the desired memory configuration.

Table 7-4 lists the available configurations and associated product numbers of DRAM DIMMs for upgrading processor memory on a line card.

Table 7-5 lists the available configurations and associated product numbers of SDRAM DIMMs for upgrading the transmit and receive buffer memory on a line card.

Table 7-4 DRAM DIMM Configurations Available for Cisco 12000 Series Line Cards

DRAM DIMM Sockets	DIMM Module	Memory Provided	Product Number
P4 DIMM0	1 32-MB DIMM	32 MB	MEM-LC-32[1]
P4 DIMM1	1 32-MB DIMM	64 MB[2]	MEM-LC-32=[2]
P4 DIMM0	1 64-MB DIMM	64 MB	MEM-GRP/LC-64=
P4 DIMM0	1 128-MB DIMM	128 MB	MEM-GRP/LC-128=
P4 DIMM0 and P4 DIMM1	2 128-MB DIMMs	256 MB	MEM-GRP/LC-256=

1. Standard (default) DRAM DIMM configuration for the processor on a line card is 32 MB.
2. For this option, it is assumed that you already have one 32-MB DRAM DIMM installed in P4 DIMM0 and that you want to upgrade to 64 MB by adding a second 32-MB DRAM DIMM to P4 DIMM1.

Table 7-5 SDRAM DIMM Configurations Available for Cisco 12000 Series Line Cards

SDRAM DIMM Sockets for Receive (RX) or Transmit (TX) Buffers	DIMM Module	Memory Provided	Product Number
DIMM0 and DIMM1	2 8-MB DIMMs	16 MB	MEM-LC-PKT-16=[1]
DIMM0 and DIMM1	2 16-MB DIMMs	32 MB	MEM-LC-PKT-32=
DIMM0 and DIMM1	2 32-MB DIMMs	64 MB	MEM-LC-PKT-64=
DIMM0 and DIMM1	2 64-MB DIMMs	128 MB	MEM-LC-PKT-128=

1. Standard (default) SDRAM DIMM configuration for line card transmit and receive buffers is 16 MB.

Also ensure that you have the proper tools at hand and that you are wearing appropriate ESD-prevention equipment.

Removing a Line Card from the Router

This section presents the procedures for removing a line card from the router. The router supports online insertion and removal (OIR) of line cards; thus, you can remove and replace any line card while the system remains powered up and operational.

Note When removing or installing a line card, be sure to use the ejector levers to properly unseat and reseat the card in the backplane connector.

To remove a line card from the router, perform the following steps:

Step 1 Put on an antistatic wrist strap and make sure that it makes adequate contact with your skin. Insert the equipment end of the wrist strap (the banana jack) into the ESD socket in the lower left corner of the upper card cage.

Step 2 Disconnect all network interface cables from the ports on the line card faceplate.

Step 3 Before you remove a line card from the router, you must first remove the vertical cable-management bracket attached to the line card faceplate. To do so, perform the following steps:

(a) Loosen the two captive installation screws at the top and bottom of the vertical cable-management bracket (see Figure 7-31).

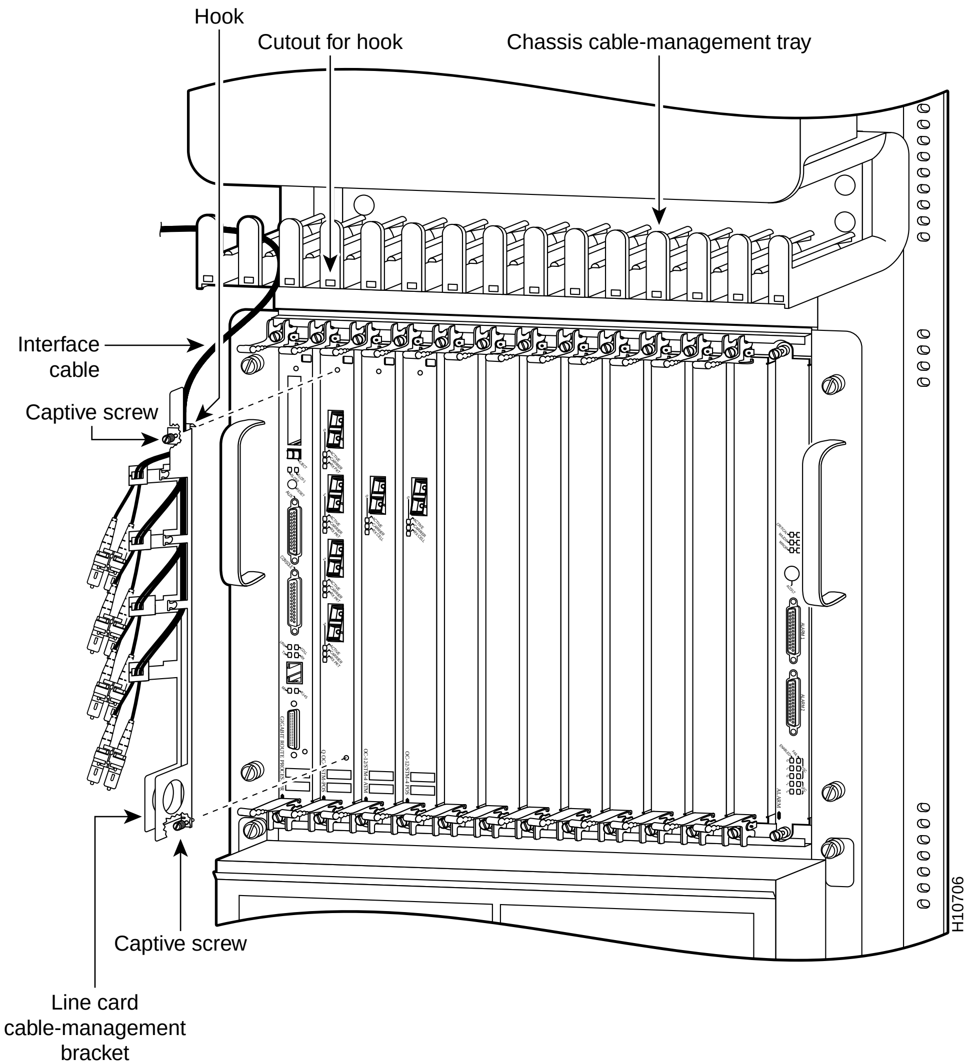
(b) Detach the bracket from the line card and hook it in the cutout located on the front of the horizontal cable-management tray (above the upper card cage).

Note Do not remove the network interface cables from the vertical cable-management bracket.

Step 4 Loosen the captive installation screw at the top and bottom of the line card faceplate (see Figure 7-32a).

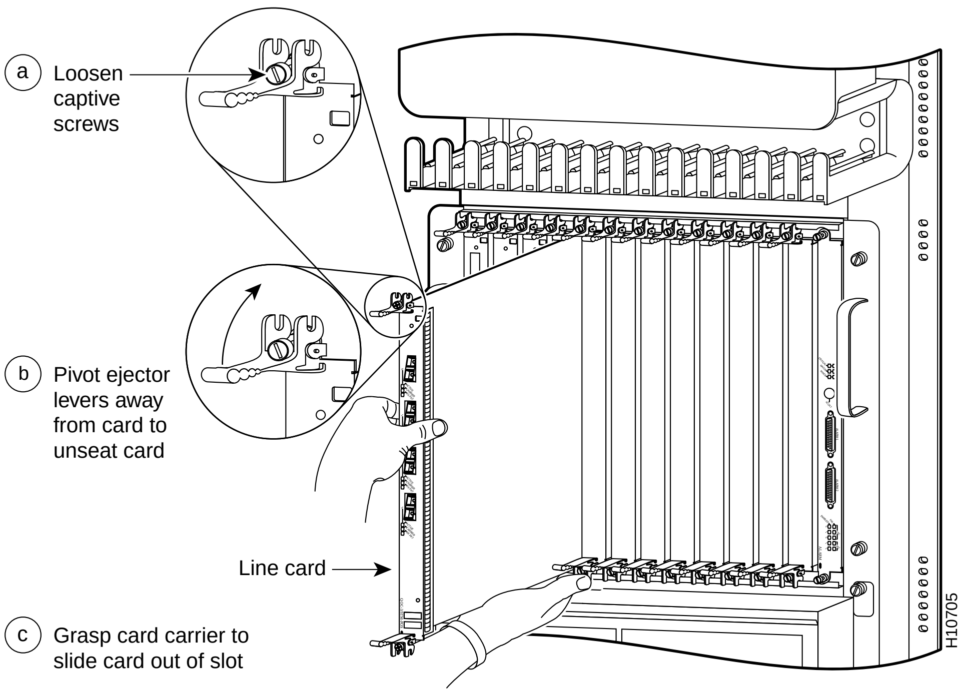
Step 5 Pivot the two card ejector levers out, away from the line card faceplate to unseat the card from the backplane (see Figure 7-32b).

Figure 7-31 Removing Vertical Cable-Management Bracket from Line Card (Quad OC-3c/STM-1c POS Line Card Shown in Cisco 12012)



Step 6 Grasp the line card faceplate with one hand and pull the line card straight out of the slot, keeping your other hand under the line card to support its weight. Avoid touching the line card printed circuit board, its components, or its edge connector pins (see Figure 7-32c).

Figure 7-32 Removing a Line Card from the Router (Quad OC-3c/STM-1c POS Line Card Shown Installed in a Cisco 12012)



Step 7 Place the removed line card on an antistatic mat or foam pad.

This completes the line card removal procedure. Proceed to the next section to remove the DRAM DIMMs from the line card.

Removing a DIMM from a Line Card

Line card memory consists of DRAM DIMMs for the line card's processor, as well as SDRAM DIMMs for the line card's transmit and receive buffers. The locations of the DIMM sockets for these two types of line card memory are shown in Figure 7-30.

The following guidelines apply to line card processor DRAM:

- The P4 DIMM0 socket must always be populated.
- The P4 DIMM1 socket can remain empty.
- The DRAM DIMMs must be 3.3-volt devices.

The following guidelines apply to line card transmit and receive buffer SDRAM:

- All four DIMM sockets for SDRAM buffer memory must be populated.
- Both DIMM sockets for a given buffer pair (either those for the transmit buffer or those for the receive buffer) must be populated with an SDRAM DIMM of the same size.
- The size of the SDRAM DIMMs in the transmit buffer need not match the size of the SDRAM DIMMs in the receive buffer.
- The SDRAM DIMMs must be 3.3-volt devices.

Caution To prevent system and memory problems, all DIMMs installed in the line card must be 3.3-volt devices.

To remove a DIMM from a line card, perform the following steps:

Step 1 Put on an antistatic wrist strap and attach the equipment end of the strap to the bare metal surface of the line card carrier.

Step 2 Position the line card on an antistatic mat so that the faceplate is nearest to you.

Step 3 Locate the DIMM sockets on the line card (see Figure 7-30).

Step 4 For the DIMM you want to remove, pull down the release lever on the DIMM socket (see Figure 7-32).

Step 5 As one end of the DIMM is released, grasp the top corners of the DIMM with the thumb and forefinger of each hand and pull the DIMM completely out of its socket.

Note Handle the DIMM only by its top corners; do not touch the memory chips or the keyed insertion fingers along the bottom of the DIMM (see Figure 7-32).

Step 6 Immediately place the module in an antistatic bag to protect it from ESD damage.

Repeat Step 4 through Step 6 for any remaining DIMMs that you want to remove.

Note If you are upgrading buffer memory, both DIMM sockets of a given pair (either the transmit buffer or the receive buffer) must be populated with an SDRAM DIMM of the same size.

Proceed to the following section to install new DIMMs in the line card.

Installing a New DIMM on a Line Card

To install new DRAM or SDRAM DIMMs in the Cisco 12008, perform the following steps:

Step 1 Put on an antistatic wrist strap and attach the equipment end of the strap to the bare metal surface of the line card carrier.

Step 2 Remove the new DIMM from its protective antistatic bag.

Step 3 Grasp the DIMM only by its top corners; do not touch the memory chips or the keyed insertion fingers along the bottom edge of the DIMM.

Step 4 To position the DIMM for insertion, orient it at the same angle as the DIMM socket. Note the two notches (keys) on the bottom edge of the module. These keys ensure proper registration of the DIMM in the socket.

Step 5 Gently insert the DIMM into the socket until the release lever is flush against the side of the socket. If necessary, rock the DIMM back and forth gently to ensure that it is fully seated.

Caution When inserting DIMMs into a socket, apply firm, but not excessive, pressure. If you damage a DIMM socket, you must return the line card to the supplier for repair.

Step 6 Verify that the release lever is flush against the side of the socket. If it is not, the DIMM might not be seated properly.

If the module appears misaligned, carefully remove it and reseat it, ensuring that the release lever is flush against the side of the DIMM socket.

Repeat this procedure for any remaining DIMM(s) that you want to install to complete your desired memory configuration.

Proceed to the following section to reinstall the line card in the router.

Reinstalling a Line Card in the Router

To reinstall a line card in your router, perform the following steps:

Step 1 Put on an antistatic wrist strap and make sure that it makes ample contact with your skin. Insert the equipment end of the wrist strap (the banana jack) into the ESD socket in the lower left corner of the upper card cage.

Step 2 Grasp the faceplate of the line card with one hand and place your free hand under the card carrier to support the weight of the card; position the card for insertion into the card cage slot.

Step 3 Gently insert the card into the slot until the card ejector levers make contact with the lip of the card cage.

Step 4 Grasp the card ejector levers at the top and bottom of the line card faceplate and pivot them inward until they are perpendicular to the faceplate. This action firmly seats the card in the backplane.

Step 5 Tighten the captive screws at the top and bottom of the line card faceplate.

Step 6 Replace the vertical cable-management bracket, as follows:

(a) Unhook the line card vertical cable-management bracket from the horizontal cable tray.

(b) Position the bracket over the front of the line card faceplate.

(c) Tighten the two captive screws at the top and bottom of the vertical cable-management bracket to secure it to the line card.

Step 7 Restore the network interface cables to their original ports on the line card faceplate.

Proceed to the next section to check the installation of the line card memory.

Checking the Installation of Line Card Memory

After installing the new line card memory, replace the card and turn on system power. The system should reboot properly.

If the system fails to boot properly after the upgrading of DRAM or SDRAM on the line card, or if the console terminal displays a checksum or memory error, ensure that the DRAM or SDRAM DIMMs are installed properly on the line card by performing the following steps:

Step 1 If necessary, shut the system down and remove the line card from the upper card cage, as previously described.

Step 2 Check the alignment of the DRAM and SDRAM DIMMs by looking at them across the horizontal plane of the card. The DIMMs should reside in their sockets at the same angle and be fully inserted into their respective sockets.

Step 3 If a DIMM is not correctly aligned, remove it and reinsert it.

Step 4 Reinstall the line card in the upper card cage as previously described, reboot the system, and perform another installation check.

If you have upgraded line card buffer memory, both DIMM sockets of a given pair of transmit (TX) or receive (RX) buffers must contain SDRAM DIMMs of the same size and speed; otherwise, the system will not operate properly. SDRAM DIMMs must operate at 60 ns or faster. The speed of the DIMM is printed along one of its edges.

If the system fails to restart properly after several attempts and you are unable to resolve the problem, contact your Cisco service representative for assistance. Before calling, however, make note of any console error messages, unusual LED states, or other system indications or behaviors that might help to resolve the problem.

The time that the system requires to initialize may vary with different router configurations and memory configurations. For example, a router with a larger complement of memory might take longer to boot.

Upgrading Memory on the RP

The *Cisco 12000 Series Gigabit Switch Router Memory Replacement Instructions* (78-4338-xx), which is available on-line and on the Cisco CDROM, contains the latest information about memory requirements and replacing memory on the Cisco 12000 series RPs and line cards. Refer to that document before replacing or adding memory to your RP or line card.

You can find the Cisco 12000 Series Gigabit Switch Router Memory replacement instructions at Cisco.com:

`http://www.cisco.com/univercd/cc/td/doc/product/core/cis12012/bfrcfig/4338bmem.htm`

APPENDIX A

Unpacking and Repacking the Cisco 12008

This appendix presents information about the shipping container for the Cisco 12008.

The shipping container, which includes a shipping pallet and an accessories box, has the following specifications:

- Width—25.3 inches (64.3 cm)
- Length—37.7 inches (95.8 cm)
- Height—31.8-inches (80.8 cm)
- Weight—approximately 44 lb (20 kg)

It is recommended that you save the original shipping container for the router should it become necessary at some later time to move the router to another location.

If your original shipping container has been damaged or discarded, you must order a replacement system packaging kit (order number PKG-GSR8=) in order to safely ship the router to another location.

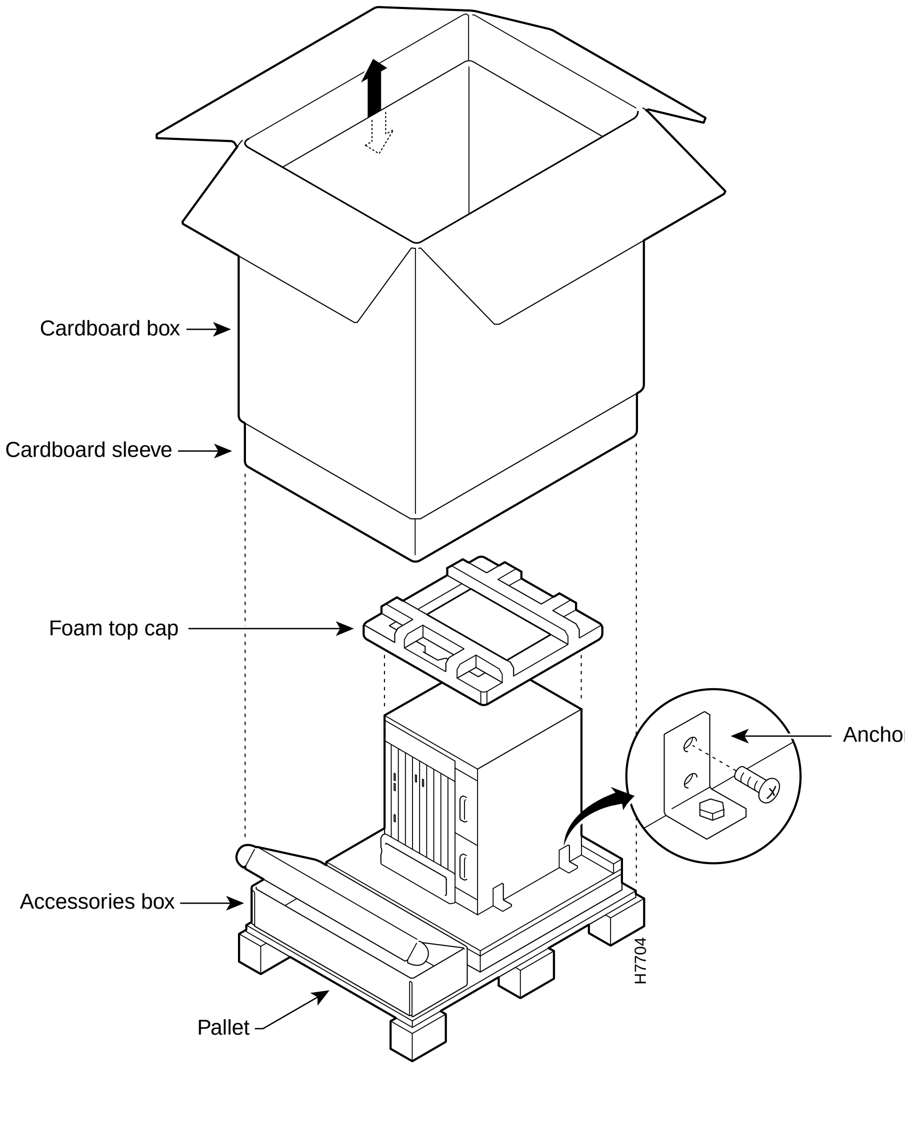
Cisco 12008 Packaging Materials

The packaging materials for the Cisco 12008 consist of the following items:

- Cardboard box
- Cardboard sleeve
- Foam top cap
- Accessories box
- Anchors (4)—two on each side panel of the router
- Shipping pallet

The cardboard box slides over the cardboard sleeve, which fits snugly over the shipping pallet, as indicated in Figure A-1.

Figure A-1 Components of the Cisco 12008 Packaging System



Unpacking/Packing Tools

For visual guidance in unpacking or repacking the Cisco 12008, refer to Figure A-1.

Caution To prevent damage, never attempt to lift or tilt the Cisco 12008 using the handles on the power supplies. These handles are not designed to support the weight of the router

You need the items in Table A-1 to unpack or pack the Cisco 12008.

Table A-1 Cisco 12008 System Packaging Tools

Tool	Unpacking	Packing	Purpose
1/4-inch flat-blade screwdriver	X	X	To remove the anchors from the Cisco 12008 side panels
Wire cutters	X		To cut the packing straps
ESD-preventive wrist strap	X	X	To prevent ESD damage
Antistatic mat or bag	X	X	To protect boards
Packing straps or carton sealing tape		X	To seal box for shipping

Numerics

A

B

C

D

E

F

G

H

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J

L

M

N

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P

R

S

T

V

W